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The Peck-Wheeler System of High Temperature (Combined Live and Exhaust Steam) Feed-water Heating.

Supplying steam boilers with feed water at a very high temperature (at or near the temperature of the steam in the boiler) is a subject worthy of more attention than it has thus far received in this country or abroad.

The many advantages of the system are apparent to any one interested, if he will investigate the subject, and although it may appear at first sight to be like "robbing Peter to pay Paul," facts prove that to heat feed water by the use of "live steam" taken direct from the boiler pays in more ways than one.

The higher feed water is in temperature the greater the economy in fuel and the longer the life of the boiler—to say nothing of the considerable increase of its steaming capacity. Heating feed water by steam taken directly from the boiler, although tried many years ago in this country, was never followed out to any successful issue (except for purifying feed water) until recently in England, where, however, the practice was limited to a comparatively incomplete arrangement.

The Peck-Wheeler system (patented) represents perfected practice, the successful result of exhaustive experimenting, and its object is, first, to obtain all the heat possible out of the exhaust steam from the main engine by operating the air pump so as to get the temperature of the feed water in the hot well as high as possible consistent with a good working vacuum—say a temperature of 120 degrees F.—and then to further heat the feed water by passing it through a small exhaust steam heater, into which the feed-water pump, air pump and circulating pump, and any other steam pump or auxiliary engine may exhaust, such exhaust steam being entirely condensed by the feed water; at the same time, the latter is raised to a temperature of from 180 to 190 degrees F., as it passes on its way to the "live steam" heater. The feed water, after being heated to maximum temperature in this special "live steam" heater, enters the boiler at very nearly the temperature of the steam within the boiler. The steam, which is condensed in producing this result, flows to the boiler by gravitation. The engraving herewith shows clearly the operation of the arrangement from beginning to end. The steam pressure in the boiler is, say, 160 pounds gauge pressure, representing about 371 degrees F. On the main steam pipe near the boiler is shown a branch pipe for supplying live steam to the high-pressure feed-water heater. After the steam is used in the (triple expansion) engine, it passes through the exhaust pipe to the Wheeler surface condenser, as shown.

The water of condensation is taken by the air pump (which is immediately under the condenser), and discharged into the hot well filter tank, where the temperature averages 120 degrees F. This feed water, after passing through the filtering material in the tank, flows to the feed pump, which forces the water to the boiler, first, through the small exhaust steam feed-water heater, where (as before stated) it is raised in temperature to about 180 to 190 degrees F. The cut shows the exhaust steam from the combined air and circulating pump, and the feed pump exhausting into said heater, where it is entirely condensed by the feed water passing through its coils or tubes, the water of condensation gravitating to the hot well filter tank below, and mingling with the feed water therein.

As clearly shown, the feed water, after passing through the small supplemental exhaust heater, enters the bottom of the "live steam" heater at one end, and flows out at the top at the other end, where it emerges at a temperature of about 355 degrees F., and then passes down to the boiler. The live steam is taken from the main steam pipe, as shown, or from the boiler direct, as preferred; this steam passes through the inside of the tubes of the heater, and after being condensed gravitates to the boiler through the vertical pipe shown on the other side of the boiler.

It will be seen at a glance how simple the whole arrangement is, and how the feed water is heated from an initial temperature of 120 degrees F. to a terminal temperature of about 355 degrees F. Or, in other words, an increase of about 235 degrees F. is obtained for the feed water in its progress from the hot well to the boiler.

The advantages claimed by the Wheeler Condenser and Engineering Company for the "Peck-Wheeler" system are as follows:

1st. Economy in the use of fuel varying from 6 to 10 per cent.

2d. Increase of steaming capacity of the boiler—varying from 15 to 20 per cent.

3d. Longer life to the boiler, as the plates and tubes are not exposed to the severe strains common to feeding water at a low temperature.

4th. Purifying the feed water in the heater.

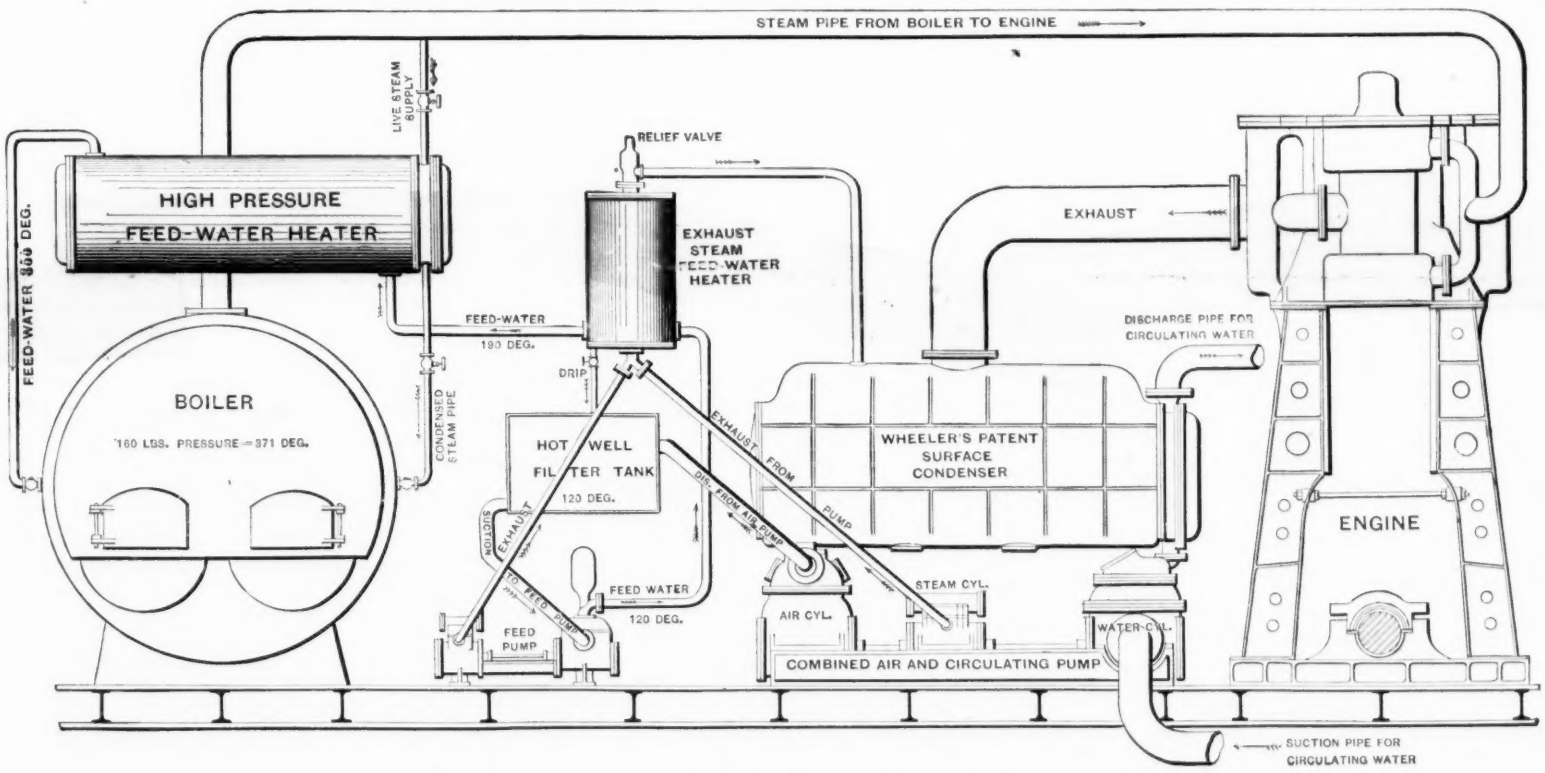
5th. Less fluctuation of steam pressure in the boiler—in other words, steam generation is more continuous and prompt.

6th. Less weight, space and first cost for boiler, and less expense for repairs.

The reason why the boiler is more free from injury with this system may be stated as follows:

When water averaging only 120 degrees F. is pumped into a boiler carrying say 160 pounds steam pressure, it cannot boil until heated to 371 degrees F., or 251 degrees above the temperature at which it was fed into the boiler. When thus pumped into the boiler this feed water of low temperature gradually mingles with the water in the boiler, reducing the temperature of the latter below the boiling point, and checking evaporation until the resulting admixture of boiler water and feed water is again heated to the boiling point. The water in the boiler is then expanded by the heat, becoming lighter, so that its particles move more freely among themselves, and thus create a more rapid circulation. As the temperature rises, the internal currents, by which the heat is carried off from the heating surface, become more rapid, and consequently more heat is carried away from said surfaces. In other words, after the water commences to boil, the buoyant steam bubbles rising through the mass of water, greatly assist in increasing the circulation, thus causing the heat to be absorbed from the heating surfaces with the greatest rapidity. It will thus be seen that it is desirable to keep the whole body of water in the boiler in a continuous state of ebullition by supplying feed water at the highest possible temperature in order to attain and maintain the most effective conditions, since heat can be transmitted to the water at about three times the rapidity while evaporation is the form of boiling is going on as compared with the same water while being heated to the boiling point.

A naval engineer,* recently writing on this subject, speaks of a marine double-ended boiler 20 feet long where the difference of expansion between the two opposite parts of the shell of the boiler would amount to about one-third of an inch with the old system of feeding water at low temperature. With feed water approximating live steam temperature such strains are entirely avoided. He also adds that the tubes of the "live steam" heater serve to a large extent as a grease extractor, and also for arresting scale-making properties in the feed water. Ready means, of course, should be provided for cleaning out the heater. He also cites the



THE PECK-WHEELER SYSTEM OF HIGH TEMPERATURE FEED-WATER HEATING.

*Assistant Engineer T. W. Kinkaid, U. S. N., in his article entitled, "Feed-water Heating," in the August number of the *Journal of the American Society of Naval Engineers.*

case of a certain English vessel that employed a "live steam" heater, and although the system was quite imperfect, yet it increased the revolutions of the engine, and the steam pressure of the boiler, and also made the work of the fireman less laborious.

Continuing, he further quotes as follows:

"The facts ascertained were simply that the heater gave a higher boiler pressure by 5 pounds, and raised the revolutions of the engines from 34 to 35½ per minute. As regards economy we have no data to go on, save that the firemen let the furnaces more alone with the heater than without.

It remains to be considered how this remarkable result can be reconciled with thermo-dynamic laws. At first sight it appears to be impossible that any result of the kind could be got, or that any economy should result. If we take into account the well-known fact that heating surface, for some reason not fully understood, is more efficient with boiling water than with cold; that all grease is kept out of the boiler, being deposited in the heater, from which it is periodically removed with soda, and that so the surfaces are kept cleaner, we can at once see that a saving of five or six per cent. is not more than is to be expected. The 'live steam' heater supplied with steam from a boiler working with feed water at a very high temperature indeed, the efficiency of each pound of fuel employed to heat that feed will be greater than it would be if the steam were supplied by a boiler working with cold feed. The fact that there is a greater gain than calculation indicates as possible is explained by the more or less uncertainty which exists as to the influence of the density of the water in a boiler on the rate at which it will take up heat. Each unit, again, of heating surface will probably in a given time transmit about the same quantity of heat, whether the water in contact with it is 200 degrees or 350 degrees, or even hotter, because the furnace temperature is always so much in excess of the water temperature that 100 degrees or 150 degrees one way or the other makes little difference, but it is obvious that, if the water be very hot, more steam will be produced in a given time per unit of surface than if it is cold. The result is equivalent to an augmentation of boiler heating surface, and, as in the case referred to, more steam will be made per hour than could be had from the same boilers with cold water. The steam taken for heating the feed is used to the best possible advantage, the whole of its contained heat being utilized; whereas if the same steam were passed through the engine, not more than twelve per cent. of its heat could be utilized by the engine."

Those interested in investigating the subject will find opportunities for doing so at the works of the Wheeler Condenser and Engineering Co., Carteret, N. J., or the company can be addressed at 92–94 Liberty street, New York.

The Natural Governing of Direct-acting Steam Pumps—I.

BY DAVID GUELBAUM.

Of the numerous machines invented and introduced into practice since the construction of the first steam engine, the direct-acting steam pump appears to be practically the most puzzling and least understood one, and this in spite of its extreme apparent simplicity. A glance over the gradual development of this machine, from the simple primitive pump up to the present enormous pumping plants, may illustrate the above statement. It would seem at first view that, having two cylinders fitted with pistons connected to each other by a common piston rod, one cylinder being provided with proper suction and discharge valves, and the other with inlet and outlet steam ports and a steam distribution valve—the only problem to solve would be how to actuate this steam distribution valve by the piston rod motion, and this having been attained we would obtain a machine ready for pumping purposes. As the above problem is but a kinematical one, it has been long ago solved in many different ways—as many as there are in the market different direct-acting steam pumps. Yet early practice already has demonstrated that such a machine does not do its work quietly and satisfactorily, and that in order to make it work better, two—or at least one—air chambers must be introduced, placed near the pumping cylinder on the discharge and suction pipes. Still, even after being fitted with air chambers, this machine proved to be practically of but limited working capacity; the piston stroke is to be made short, shorter than in ordinary steam engines; the steam is to be worked at low and uniform pressure without any cut-off; adding to this the usual slow motion of such

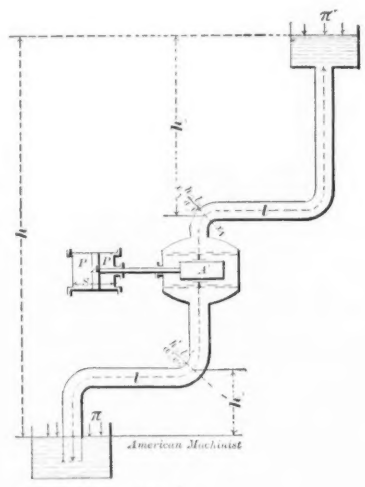


Fig. 1

a pump, it proves to be practically a machine inferior in capacity and efficiency as compared even with a primitive steam engine of equal size. To raise these pumps to the standard efficiency of a modern steam engine, special compensators are being introduced at present, as, for instance, the so-called Worthington high-duty attachment, consisting of double oscillating cylinders fitted with pistons working upon compressed air. All these and many other accomplished improvements represent undoubtedly great engineering achievements. But if, in order to make a column of water move within a force pipe, so much trouble and engineering genius is required, then it is time to stop and inquire: What are the real laws of motion of this water body and of driving it by direct-acting steam pumps? Are all the difficulties met with in practice due to the nature of the required motion? Is the present complicated method of governing high-duty direct-acting steam pumps the only possible one? An attempt to give a clear scientific answer to the above questions, by formulating mathematically the fundamental laws of motion of a direct-acting steam pump, is the object of this article. These laws expressed in letters and figures indicate plainly the difficulties met with in the practical working of a direct-acting steam pump, exposing at the same time the natural means for overcoming these difficulties, and also indicating the extreme conditions under which a direct-acting steam pump cannot be governed by natural means and must be provided with the modern compensator or high-duty attachment.

I shall consider first a direct-acting steam pump, such as shown in sketch, Fig. 1, which consists simply of a steam cylinder connected to a pumping cylinder raising water directly from a lower reservoir to an upper reservoir without any intermediate air chambers. The mode of working the steam cylinder may be either at uniform steam pressure or with an average steam expansion, but without foreign moving bodies like compensators connected with the pistons. The main distinctive feature of this machine lies in the fact that its rectilinear movement is constructionally unrestricted, and that all its moving parts taken together represent a free body subjected only to the action of external forces, while in an ordinary steam engine the stroke of the piston is restricted by the crank, and the piston velocity at any moment is determined by the fly-wheel rotation. The dynamical laws which govern the motion of a free body under external forces were established long ago in analytical mechanics, and a systematic application of these laws to the motion of a direct-acting steam pump brought to my mind formulas which I believe to be new, and which give instructive results. But as these involve calculus and the higher branches of mechanics, and are very complicated, I will leave out the correct mathematical proof of my propositions, and show at once the nature of the motion of a direct-acting steam pump as it appears from the results arrived at by the mathematical investigation.

It is evident that the task of governing the working of a direct-acting steam pump would be much simplified if the water in the mains possessed the qualities of a solid body, *i. e.*, if the water particles were closely connected to each other, and also to the pump piston. In such a case the velocity at any time of every moving particle would be equal or in a constant ratio to that of the piston, and the water in the mains would begin to move and come to rest at the same time as the piston does, so that no water blow or slip could take place, and, therefore, also the opening and closing of the suction and discharge valves would occur regularly and in due time; the task of governing such a pump would be simply reduced to the task of governing the steam piston stroke. But in a satisfactory working of a direct-acting steam pump the above conditions are actually fulfilled, *i. e.*, a full water displacement takes place at each stroke without interruption between the water columns and the piston, both beginning to move and coming to rest always at the same time. Therefore the first question to be decided is: What are the conditions necessary to be fulfilled to keep the water columns in the mains during the whole stroke in close contact with the pump piston? The analysis shows that breaking of the water column at any cross-section of the mains will be the more liable to occur—1. The greater the ratio of the surplus of the original steam pressure minus the exhaust steam pressure above

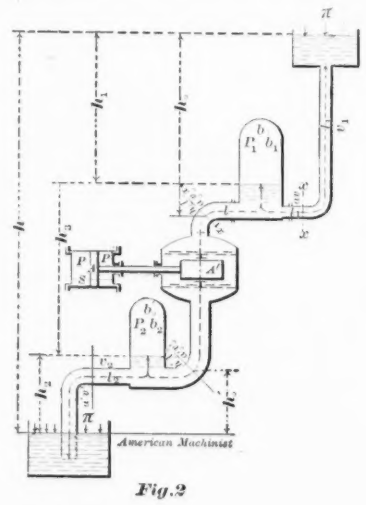


Fig. 2

the total resistance pressure against the pistons to this total resistance pressure, *i. e.*, the higher the steam expansion; 2. The less the ratio of the cross-sectional area of the main to the area of the pump piston; 3. The less the ratio of the total weight of all moving parts to the weight of the part of the water column in the discharge or suction main inclosed between this cross-section and the corresponding reservoir; and 4, the less the ratio of the pressure in this cross-section of the main to the total resistance pressure against the pump piston. The condition to be fulfilled to prevent breaking of the water column at any cross-section of the mains is expressed in the following formulæ giving the relation between the just mentioned quantities, namely:

$$\frac{P - P^1}{r\ q\ H} - 1 < \frac{c\ l_0}{A_1} \times \frac{L}{l_0} \times \frac{\pi + q\ h_0}{q\ H}. \quad (1)$$

Here P = the original steam pressure;

P^1 = the pressure of the exhaust on the opposite side of the piston;

H = the total forcing height between the lower and upper reservoirs, plus an additional height equivalent to the frictional resistance;

q = the weight of one cubic unit of the pumped liquor;

r = the ratio of the area of the pump piston to the area of the steam piston; the product $r\ q\ H$ expresses the total resistance pressure per unit of the steam piston area;

a_0 = the cross-sectional area of the discharge main at any given point;

A^1 = the area of the pump piston;

L = the total length of the water column between the lower and upper reservoir + the length of an additional water column of a cross-sectional area equal to the area of the pump piston and equal in weight to the solid moving parts;

l_0 = the length of the part of the water column in the discharge main from the given cross-section up to the upper reservoir;

h_0 = the vertical distance of the given cross-section from the level in the upper reservoir;

π = the atmospheric pressure.

Units of lengths and pressures are here arbitrary, as the formulæ contain only ratios.

Formula (1) expresses the law of continuity of motion of all the combined parts of a direct-acting steam pump, namely, that if in an ordinary direct-acting steam pump the above-mentioned different quantities are so proportioned as to satisfy the condition that the first above-mentioned ratio is less, or at least equal to the product of the three other above-mentioned ratios, then the water in the mains will form one body with the solid moving parts, and no water blow or slip will ever take place.

NOTE:—Applying formula (1) to the suction main the quantities a_0 l_0 and h_0 should be replaced by $a^1{}_0$ $l^1{}_0$ and $(-h^1{}_0)$, as indicated in sketch (Fig. 1).

Before proceeding further, the following questions must be cleared up. First, What is to be understood by the total weight of all moving parts, as mentioned above in the third ratio? As seen in sketch (Fig. 1), the suction and discharge mains, the pump piston, as well as the valve openings, may and will have in practice different cross-sectional areas, so that the water passing through will have different velocities at different points of its path. The influence of any moving part will be the greater the higher its velocity. Therefore, in taking the weight of different moving parts, they must be first reduced to one standard velocity. The analysis shows that the effect upon the pump motion of the water columns in the mains is the same as if their cross-section would be uniform and equal to the cross-section of the pump piston, and moving with the same velocity as the piston, independently of the actual different diameters of the mains. According to this, in taking the weight of the moving water column, its total length should be multiplied by the area of the pump piston.

The next question is, What will be the effect of an air chamber placed somewhere on the main between the pump and one of the reservoirs?

Practically, in such a case, the pump at every stroke will displace water in the air chamber, there being always—as assumed—a large air volume, while the water will be forced into the main behind the air chamber by the excess of the air pressure in the air chamber above the pressure in the mains + the friction. In case the air volume in the air chamber is large enough, as compared with the water displacement of the pump at each stroke, then the air pressure in the air chamber will vary very little during each piston stroke, and, therefore, the motion of the water column in the main behind the air chamber will go on continuously with but slight changes in its velocity, independently of the mode of working of the pump. Therefore, in his case, the air chamber will actually represent the final reservoir into which the pump is working, so that a pump mounted with air chambers may be considered as an ordinary pump without air chambers, whose discharge and suction mains are equal in length to the part of the mains between

the pump and the air vessels, with no other difference, as far as the piston motion is concerned. Therefore, the above law of motion continuity will be equally applicable to a direct-acting steam pump, with or without air vessels, only the quantities of formula (1) are to be taken as indicated in the corresponding sketches (Figs. 2 and 1). On account of this, in the following considerations we shall have in view a normal direct-acting steam pump, *i. e.*, one mounted with air vessels, and worked either with uniform steam pressure, or with an average steam expansion.

Comments on the Patent System.

BY C. L. REDFIELD.

It has become quite a common practice for certain persons to find fault with the present patent system. Some individuals would like to have a patent granted for anything to anybody who would make application for it, and pay the requisite fee, while others would like to have the United States government stand back of and guarantee the validity of every patent issued. Between these two extremes there is every shade of opinion, and between them undoubtedly lies the true ground.

Much of the opinion adverse to the present condition of things is due either to an ignorance as to what now exists, or a desire to have things different for some personal reasons. It is quite true that many things relating to our patent system could be changed to advantage, but it is equally true that these changes should come in the shape of improvement on what we have, rather than the substitution of something totally different.

It has been said that the possession of a patent simply gives the owner the right to sue and be sued. While this is somewhat of a pessimistic view of the matter, a patent at the present day at least gives this much, if it does not give any more. Under a system similar to that prevailing in most foreign countries, where a patent is granted to any one applying for it, a patent would hardly give this right. It would simply be an evidence that some individual had represented himself to be the inventor of such and such a device. As every one has at some time met the self-styled inventor who is always going to get a patent, and have the world by the tail, but who never does, it is not difficult to imagine what would be the condition of things if all of these individuals could get patents as easily as this free-for-all patent system would make it.

This kind of a patent system would very largely increase the business of the patent attorneys, and it is, therefore, not surprising that some of its advocates are found in that class. The increase in the attorney business would not so much be due to increased number of applications as it would to the fact that inventors and purchasers of patents would have to employ attorneys to look into the scope and validity of every patent which made any pretensions to be anything.

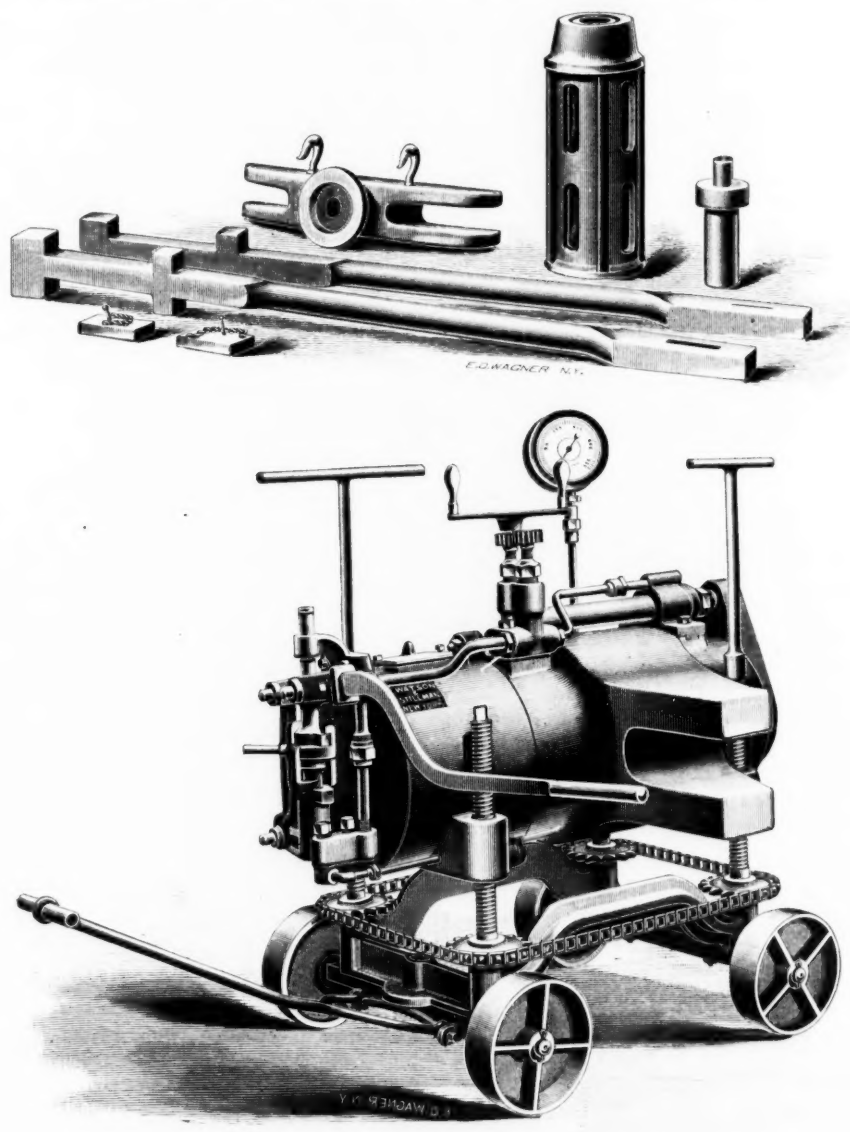
Examination into the question as to whether or not a certain device is a new and useful invention, is the real meat of the whole matter, and one which it is well to carefully consider. Any decision on this matter, whether it comes from an attorney, the Patent Office, or the courts, is in reality the expression of individual opinion, and that opinion is sure to be influenced more or less by the extent of the examination and the bias of the individual making it. Therefore, if the person making or owning an alleged invention really wants to know whether the thing is new or not, it is of prime importance to him to have that examination as thorough as possible, and also have it made by some one who has no personal interest in the nature of the decision. To err is human, and to employ an attorney to examine into the validity of a patent is to invite him to err in the interest of his own pocket. No matter how honest and conscientious he may be, he naturally starts out with the wish to find his client's patent valid, and the other fellow's patent invalid, and hence he is apt to look more assiduously for certain things than he is for certain other things.

Any investigation into the merits of an invention must be limited by the facilities for examination, and the time consumed, and any attorney who makes an examination comprehensive enough to be of any value must necessarily charge a large fee. Under the present patent system the applicant may, if his attorney does his business properly, compel the Patent Office to make this examination in quite a thorough manner, for the sum of fifteen dollars. The facilities for examinations of this kind by the patent officials is superior to that at the command of any attorney, and while not all of the examinations, nor even the majority of them, are comprehensive, the power is within the applicant to make it equal or superior to one that an attorney would charge from five hundred to a thousand dollars for.

This much may be said for the present patent system as against the free to-anybody system advocated by some, and it is not unreasonable to suppose that the person who is expecting to spend his own money on some given device would like to have as much assurance as possible that he is not wasting it. This consideration doubtless gives rise to the wish that the government would guarantee and protect every patent issued. Without going into the reasons why this would be impracticable, it will be sufficient to point out that it could not but produce injustice to many. For example, suppose John Smith patents a device that Tom Brown has been making for some time. As Smith would have a guaranteed patent, Brown would be helpless, and would have to abandon or pay royalty for that which he himself was the original inventor. It is true that the government might issue a patent, and then guarantee it after a certain time, but this would compel the government to take an indefinite amount of testimony from all sorts of individuals at all sorts of places, and this would put the cost of a patent out of the reach of any but the wealthy.

The present system offers a good many opportunities for the applicant to take advantage of for his own benefit, if he knows how, as the compelling the office to make the comprehensive examination before referred to. In some cases, applicants, and especially rich corporations, not only take these advantages, but actually abuse the privileges that are permitted. Most inventors, and particularly those who are making their first applications, are anxious to get their patents issued as quickly as possible. The old hands at the business take exactly the opposite course, and delay the issue as long as possible, well knowing that the life of the patent extends seventeen years beyond the day of issue. As an example, a patent was recently issued after lying in the office for fourteen years, and the owners have consequently secured protection for a term of thirty-one years. This is manifestly an abuse of privilege, and a circumstance that is at variance with the spirit, if not the letter of the law.

Various remedies have been suggested for this state of things, but, as far as I am aware, they all relate to some means for expediting the patent through the office. While this would doubtless cure the evil, it is likely to work injustice to many innocent parties, for applications often get unexpectedly tied up in interferences. A much better plan would be to add a clause to the law, providing that the life of no patent should extend to a date more than twenty years subsequent to the day of first filing in the Patent Office. This would give every applicant all of the time he wanted in which to obtain a patent, while at the same time there would be no object in needlessly delaying the issue.



DOUBLE PUMP PORTABLE CRANK-PIN PRESS.

Double Pump Portable Crank-pin Press.

The accompanying illustration is of an unusually heavy and powerful portable hydraulic press intended for engine or similar work, where the pressures occasionally required are high, and where it is much more convenient to take the press to the work than to take the work to the press.

The cylinder and the beam are in one piece, to secure lightness, and it is mounted upon four screws, which are connected by chains, so that the machine may be raised or lowered by applying a wrench to any one of the screws, or, if it is desired, the chain may be removed, and the screws operated separately.

There are two pump plungers, one of which moves the ram four times as fast as the other, the maximum total pressure by the larger plunger being 60 tons, while with the smaller a pressure of 250 can be obtained. The change from one plunger to the other is made at will by the geared valves seen on top of the machine. For withdrawing the ram a small cylinder is placed on top, the ram of which is connected to the larger ram. The attaching rods, which pass through the yoke, may be as large as 4″ diameter, and their distance from center to center can be adjusted from 23″ to 38″. The center of the large ram can be adjusted from 20″ to 32″ from the floor.

To go with this or any other similar press made by the same firm, the appliances shown in the second engraving, though not necessary, may be used with great advantage. In forcing in crank-pins, for instance, the small yoke placed at the back, with its counterbored face next the hub, allows the end of the pin which is to be riveted over to come through and project, and no washers are needed. In removing pins, this same yoke is used, but a forcing pin shown at the extreme right is used, the collar on this fitting the recess in the face of the yoke. The sleeve shown slips over the pin to be taken out, and the ram acts upon it. The yoke is made of the same length as that on the press with which it is to be used, and can be suspended by the hooks from the axle, thus avoiding the necessity for blocking it up, and can be readily handled. The rods are made without nuts, and in such form that there is no liability of the press assuming other than the correct position. These presses and appliances are made by the W. & S. Hydraulic Machinery Works, 204–210 E. 43d street, New York.

Mutual Benefit Societies in Connecticut.

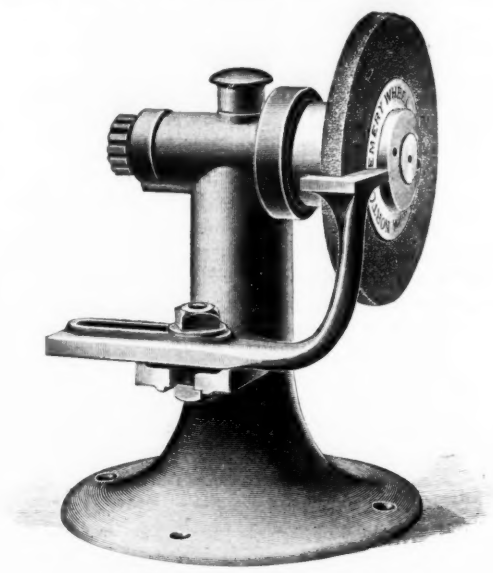
A report recently issued by the Connecticut Bureau of Labor Statistics goes somewhat into the matter of co-operative benefit societies doing business within the State, the justification for a labor bureau investigating such a matter being, presumably, the fact that those organizations are supported mainly by workingmen. The total number of fraternal benefit societies doing business within the State was found to be 386, with a total membership on Dec. 31, 1891, of 126,613. The growth of these has been rapid during the five years over which the examination extended, and has been most rapid during the latter part of the period. The list includes societies of all kinds having benefit or endowment features, some of these being quite old, and one dating back to 1821.

Many of the endowment societies refused to make reports of their business, and others went into the hands of receivers during the examination. Many of the societies are legitimate and sound, of course, and their growth must be attributed largely to the diminishing margin between actual necessities and gross income received by working people in many lines; but it is also to be attributed in part, we think, to the ambition of individuals who think that, by starting some new endowment or mutual benefit society, they can keep at the head of it, receive a salary, and get along without work. This theory is strengthened by the fact that in some instances the cost of management rose as high as 80.55 per cent. of the benefits paid.

All such societies undeniably partake of the nature of socialism—though they are to be neither condemned nor commended on this account alone, the sole question, so far as we can see, with regard to them being whether or not they do, or are capable of doing good work. It at least behooves every workman or woman who is approached by an agent of one of these societies to examine it, and if its promises are extravagant, or its methods involve gambling on chances of others paying for a time and then dropping out, to keep entirely clear of it.

A New Bench Grinder.

The accompanying illustration is of an emery grinder, which is intended to stand upon the bench, and be used for tool and such general grinding as is usually done in a machine shop or other department of a manufactory. It is called by the makers "The $5 Grinder," and though made in a first-class manner, with taper bearing adjustable for wear, protected from dust and provided with efficient oiling arrangements, it is designed to be so simply constructed, so low in cost, and to occupy so little room that plenty of them can be put in, so that no one need go far to reach grinding facilities. There is an oil chamber at the top, and waste oil is carried away in the center of the column. The machine is 9" high, weighs 20 pounds, has a pulley 2½ 'x1½", and will carry a wheel 10" diameter, 1" thick. It is made by the Norton Emery Wheel Co., Worcester, Mass.



A NEW BENCH GRINDER.

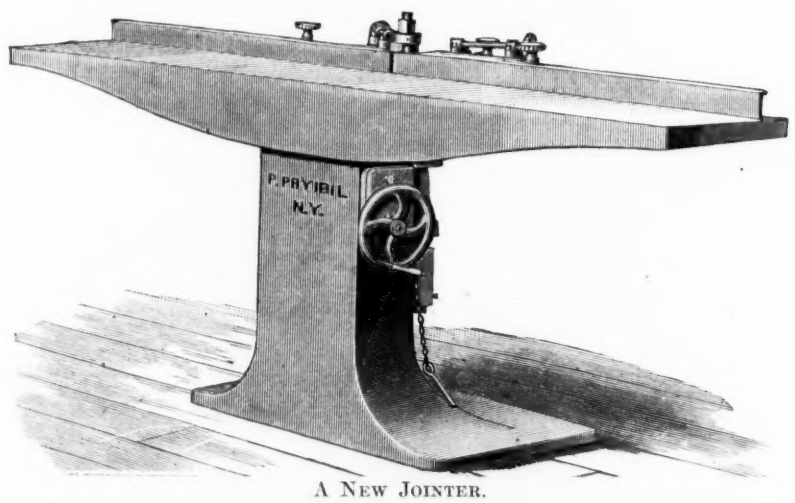
A New Jointer.

Every one who has tried to joint the edges of wide, thin stock, on the ordinary buzz planer, knows that one difficulty arises from the fact that the stock has a constant tendency to turn over and lie flat on the table. With the machine shown by the engraving advantage is taken of this tendency, and the stock is placed in its natural position, flatways, on a long table having fences at the back, and is operated on by cutters carried by an upright spindle.

The fence is constructed in the same manner and with the same adjustments as the two tables of a buzz planer, and the depth of the cut and the width of the throat opening can be varied at will.

Besides edge jointing, this machine, with its fences, can be used for straight molding, tonguing, grooving, etc. When it is desired to use it for variety molding, the fences can be easily and quickly removed, and the cutter head can be replaced by the collars and cutters ordinarily used for this class of work.

The regular cutter head carries four cutters, which are above the table, where they can be easily and accurately adjusted to do twice the amount of work that can be done by the two cutters of an ordinary buzz planer. The wide range of work to which this machine is adapted renders it very valuable, and enables it to be kept busy even when not required for edge jointing, but the speed and accuracy with which it performs the latter class of work alone justifies its use. It is made by P. Pryibil, No. 498 to 510 W. Forty-first street, New York City.

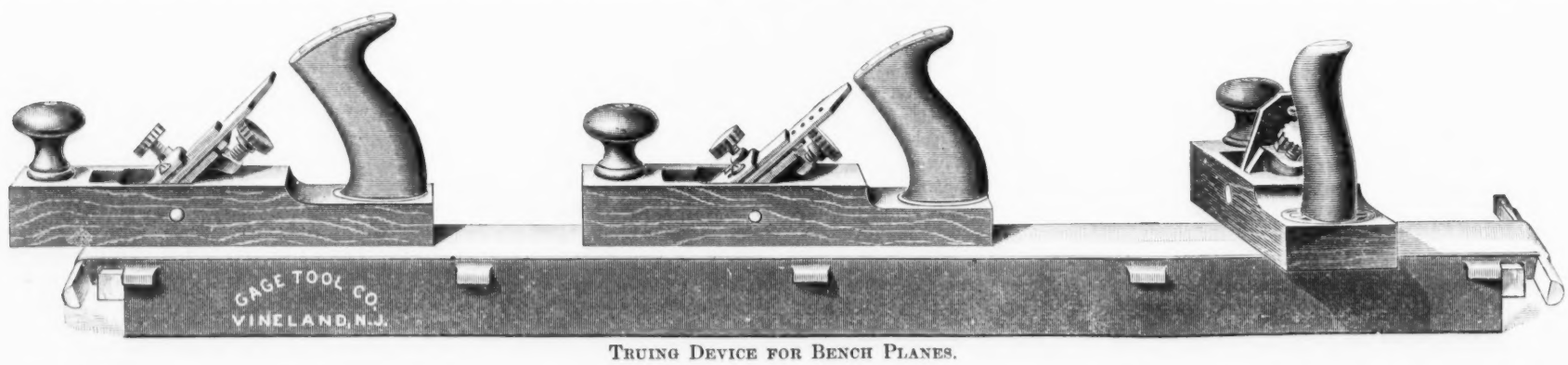


A NEW JOINTER.

Truing Device for Bench Planes.

Nearly every one who has had much experience with bench planes knows that the faces of them wear out of true, and that when this occurs the work done by them is either out of true also, or to get it true requires much more attention and time than would otherwise be necessary. Nor is it a good plan to allow a plane to get as much out of true as can possibly be permitted before truing it.

Our illustration is of a device which is intended to be always at hand, and to afford a ready means of preventing a plane, or rather the planes of an entire shop, from becoming noticeably out of true. It consists of a plate of cast-iron, resembling a miller's proof staff, webbed on the under side to give stiffness without undue weight, the top of this plate being planed true, and provided at the ends with facilities for clamping a strip of sand-paper, which is stretched tightly over the planed surface. The ends of the strip are first secured by the square blocks driven in below the projections at the ends, after which the stretching is done by the double wedges, which are forced in at the extreme end, as shown. The result is a perfectly true abrading surface, which can be used at any time in the manner indicated in the engraving, *i. e.*, placing the plane face down upon it, and moving it back and forth until true. Iron planes can be trued in the same way by using emery paper or emery cloth, instead of sand-paper. The makers, who are well-known plane manufacturers, state that no plane should be allowed to get into such condition that more than five minutes will be required to true it, and by this means the greatest possible service will be obtained from a plane consistent with keeping it in good condition. The several positions of the plane upon the plate are intended to show the positions taken when it is advisable for any reason to reduce the surface at some particular locality. The device is also well adapted for use in printing offices in planing cuts. Since no wear comes upon the planed surface of the plate, it should never be necessary to buy more than one of them, even for the largest shops. The device is made by the Gage Tool Co., Vineland, N. J., whose well-known self-setting plane is shown upon it.



TRUING DEVICE FOR BENCH PLANES.

When some company with a high-sounding name offers a workingman three or four times the usual rate of interest for his little savings, he should walk on the other side of the street, and keep his pocket covered. A good many of these fraudulent companies have been brought to grief, others are in the line of coming to grief, and still others will come there. The only trouble is that the depositors will be the principal sufferers. It is comparatively easy to determine the customary rate of interest. When some company offers three or four times this, it is a good thing to button up the pocket with the little hundred or two hundred dollars.

Remarks on Shop Comfort and Abuse of Tools.

BY W. D. FORBES.

Most of the time that the writer is awake he is in his machine shop, so it is fair to say that the smoothness of its working is of vast importance to him, not only because easy running generally means good profits, but on account of its effect on his nervous system.

All of us who have run machine shops have noticed what a difference it makes in our treatment of our fellow-man, particularly if he be a drummer, if the work in hand is coming out well and as expected, or whether for some petty reason it is put back. The small annoyances seem really to upset us most, the discovery that a chuck jaw is broken, or that a drift has been used which almost ruined a drill press spindle, will cause the writer to be unjust or disagreeable, with the inevitable result of everything seeming to go wrong.

Is there any way to prevent the abuse of tools in a small machine shop? Most people will say, "Get men who are careful," or "Hold a man responsible for the condition of the tools he uses." The first condition would do the business, but as the writer's shop is not in the celestial kingdom, but in Hoboken, the men cannot be had; the second would not answer in a small shop where men have to be shifted from one tool to another; but is the fault always with the men? In the writer's opinion, much of the unsatisfactory condition of machine tools after even short use is due to the makers; for instance, there is in the head-stock of a certain build of lathe, which is thought by many to be the best in the market, a little round nut for shifting the back gear to direct driving; it has four $\frac{3}{16}$ holes in it for tightening, in which a pin must be used; they are hard to reach, and in a very short time the holes are all out of shape and of no use, and look bad; it is not fair to expect them to last, yet they look as if abused. The Vs of a lathe of any size just under the live spindle in a short time get full of nicks and bruises from the chuck being dropped on them. It is true the Vs there are of no use; now if they were not there at all for about eight inches, but the bed nicely rounded over in the pattern and left unfinished, this apparent abuse would cease; and besides, the chips usually brushed into the driving gear or onto the floor could with ease be brushed into the chip box; of course the Vs could be chipped off, but then the appearance of the lathe would not be improved, as it would look like a botch job. One New Jersey concern puts nice little brass overcoats on the Vs to prevent this trouble, and the writer got some, but found that they caught chips to an extent which made them a nuisance.

Returning to drifts, one make of drill press has a sort of permanent drift fitted to it which works very well, but the hammer marks about it after a short time spoil the looks of the tool, and a gear just above the drift soon has some very unorthodox forms of teeth.

The fact that twist drill makers mark the size of the drill just where the first time it slips in the chuck the marking disappears, used to cause the writer much loss of time and money (it has probably cost the world thousands of dollars), but by resorting to taper shanks down to ¼ inch, even at an increased first cost, he has found it to result in a saving. Now comes along a drill and chuck, which absolutely prevents any slip, and a straight shank is used; it rather looks as if the use of this new drill would pay, but how about breakage? It may not have struck the reader, but there seems to be no mechanical device which gives so large a return for an outlay of cash as a twist drill. How nicely they are made, and how perfectly they do their work, yet there must be something much better for some holes, as the following goes to prove.

Having to make some holes in machine steel, the writer started a first-class man at it, with the result of a hole in five hours. Pratt & Whitney offer him a machine to make these holes at the rate of 60 per day. In the wording of the day, "We are not in it," or, more properly, against this Yankee company we are very much in a hole.

The tool offered the writer saw, and it did not have half the power of the machine on which the work was done, so the only conclusion to arrive at is that the cutting tool was better, or that they know more about holes up in Hartford than the writer does.

The introduction of twist drills, taps, reamers, semi and finished nuts, well-made screws and bolts, and a lot of other "annoyance preventers," has been conducive to shop happiness, and added to the lives of all of us, yet it does not seem that we appreciate the great labor it has taken to

arrive at this state of almost perfection, as we now take them as a matter of course.

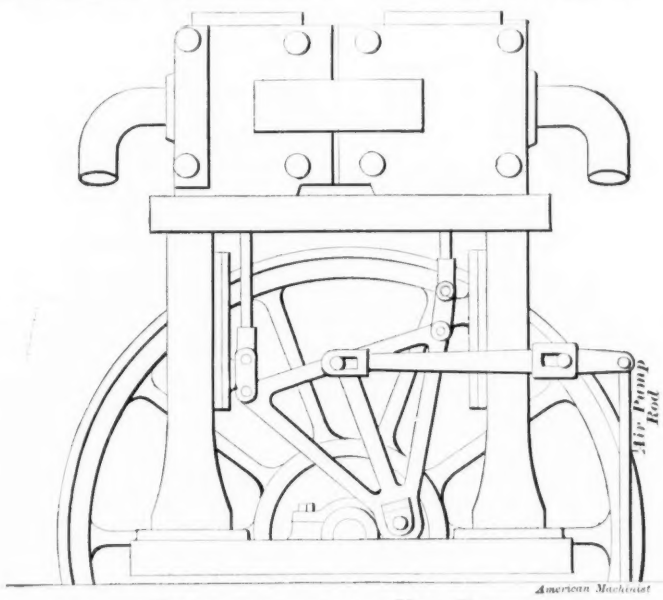
The name of Morse is about as firmly attached to a twist drill as Gatling is to a machine gun; he may not have invented it at all, but, as far as can be learned, he brought drill manufacture to a state of perfection, and so advanced us towards complete shop comfort, which ought to make him proud of his life, and worthy of the admiration of all mechanics.

Quadruple-expansion Mill Engines.

BY M. E.

Considerable interest is being manifested by the cotton-spinning community of Lancashire in the application of quadruple-expansion engines to mill driving, and more especially in the type as exemplified by the fine set formally started on the 22d October at the Peel Spinning and Manufacturing Company's mill, Bury. The makers are the well-known firm of engineers, Messrs. John Musgrave & Sons, Ltd., Bolton, who, it is generally conceded, have in this engine reached the latest development of steam engineering for mill-driving purposes.

With regard to the economy of the quadruple engine opinion is still largely divided, but as the triple-expansion mill engine is now frequently met with and its use is being rapidly and widely extended, there does not appear any good reason why, with suitable steam pressures, quadruple engines should not in their turn receive a similar preference, more especially for localities where fuel is costly. There can be no question that, under the conditions which now prevail in the Lancashire cotton-spinning industry, mill owners cannot afford to equip their mills with any but the most economical engines; and with the immediate prospects of dearer fuel and increased foreign competition the case for the quadruple-expansion engine appears to be already clearly established. It cannot, of course, be denied that the advantage to be obtained by increasing the steam pressure from say 160 pounds per square inch in the triple-expansion engine to 200 pounds in the quadruple is relatively small, but so long as the gain thus obtained is not offset by any corresponding losses, such as increased interest on first cost, greater risk of breakdown, etc., it is clearly to the mill owner's advantage to avail himself of the economy to be obtained by the use of high-pressure steam. Beyond the relatively small gain in steam economy, the principal objections to the use of the quadruple engine are—increased friction, greater complication and larger space occupied. All these objections, however, Messrs. Musgrave claim to have overcome by adopting the ingeniously arranged engine roughly indicated in the accompanying sketch. This type of engine in a somewhat different form has for several years been favorably known in the marine service, several sets having been made by the patentees, Messrs. Fleming & Ferguson, of Paisley, Scotland. As will be seen, the engine is of the vertical type, and it will be further understood that the four cylinders are disposed in pairs on either side of the rope-driving drum. The novelty of the arrangement, however, consists of the triangular-framed connecting rods, each of which is connected to the two crossheads of the corresponding pair of engines by means of short links. The lower end of the triangular connecting rod acts direct onto a single crank, and as the other set is similarly arranged, but drives onto a crank 180° in advance, the two sets of reciprocating weights are effectually balanced. Owing to the somewhat peculiar action of the connecting rod, the pistons of each pair of engines never reach the end of their respective strokes at the same instant; indeed, the resultant turning effort of each pair of pistons upon the shaft resembles that obtained by using a pair of cranks set at right angles to each other. The arrangement has also the advantage of effecting a gradual change in the efforts on the crank-pin, thus enabling the engines to be run at a high speed without pounding or vibration. From the sketch it will be seen that a horizontal vibrating lever is pivotally connected to the center of the upper member of the triangular connecting rod, and, as this lever turns about a fixed pin in the framing, the ends of the rods which are coupled to the crossheads move nearly in vertical lines and thus diminish the lateral pressure on the guides, reducing friction and wear and tear. This arrangement gives an exceedingly compact engine, all parts of which are easy of access, while at the same time comparatively little head room is required. The small floor space required is very noticeable, the engine room in this instance being only 32 feet by 38 feet, or about one-third that usually necessary for a horizontal engine of equal power. In the particular engine under notice the cylinders are 18, 26, 37 and 54 inches in diameter respectively and the stroke 4 feet 6 inches. All the cylinders are fitted with the makers' Corliss valves and trip gear, the admission valves for the first and second cylinder being controlled directly by the governor, and providing for a variation of cut-off of from 0 to ¾ stroke; in the third and fourth cylinders the cut-off is adjustable by hand. With a steam pressure of 200 pounds per square inch, and running at 80 revolutions per minute, the power developed is 1,600 I. H. P. Two air pumps are provided, each being 26 inches in diameter and having a stroke of 15 inches. These are driven by a prolongation of the horizontal vibrating lever previously mentioned, and indicated in the diagram. The crankshaft is



QUADRUPLE-EXPANSION MILL ENGINE.

16½ inches in diameter, swelled to 19 inches at the wheel seat. The shaft-necks are 15 inches in diameter and 30 inches in length. The crank-pins are 9 inches in diameter and 10½ inches long. Power is transmitted to the various lines of shafting by 36 cotton driving ropes 1⅝ inches in diameter, the rope-driving drum being 21 feet in diameter and having a circumferential velocity of 5,280 feet per minute. This gives a somewhat higher speed of the ropes than the average practice, but some of the secondary driving ropes run at a still greater velocity—5,654 feet per minute. The engine is very complete in every respect and is furnished with the usual barring engine for the purpose of turning the engines, to clear them of water when starting, or when repairs or adjustments are being made.

Gantlet—The Presumption of Brains.

BY JARNO.

A legend runs that in former times it was not uncommon for some men to be inclined to claim as their own the new ideas and inventions of other men. This inclination, I am happy to learn, is so very rare nowadays that the meeting with a man like Secretary becomes worthy of note.

No matter what kind of machine it is, or how successfully it is running, so long as it has not been changed by him, it lacks the one thing necessary to insure final success. This one thing Secretary is quite willing, and even eager, to add. He wonders why the designer did not think of it, and dwells, with peculiar satisfaction, upon the good fortune of all concerned, in having him to add the life principle. After this, the credit of designing the whole machine belongs to Secretary, from the beginning.

A remarkable time it was, the day that Secretary could not think of an improvement in doing a piece of work that he had, for many years, seen done in the old way. His genius, however, carried him through, when he remarked to the designer, "You ought to have thought of that ten years ago." He then pointed to a piece of waste at one end of the machine, and asked whether it were a counterbalance.

This sort of patronage from Secretary is much sought after. When he indulges in it, he is in good humor.

Waubug Mephit is one that soaks up the ideas of others, and afterward claims them as his own. He can also supply the missing check nut that will hold success to a machine, but he is not so politic as Secretary, and is often caught in piracies. Some years ago Wilbro handed Waubug a sketch of a chuck for approval. He returned the sketch, deciding that it probably "would not work," and that, even though it were good, the design was to be changed, and it would then be inoperative. In one year, Waubug brought out precisely the same chuck, and took it to Wilbro, who promptly brought forward the old sketch, and in turn presented it to Waubug as a memory jogger.

It was only the other day that Waubug was caught again. A paper machine expert had been troubled at one point. A German told the expert of his own experience in Germany, and drew a sketch showing how he had overcome the difficulty. The expert put the sketch in his pocket, feeling sure that Waubug would claim the idea, because he and the German had been talking together; and so it turned out. Waubug brought the selfsame idea in a sketch to the expert, exclaiming, "I have a scheme that will overcome the difficulty you have had."

The expert listened until Waubug had finished with his description of the scheme—a thing that Waubug could not possibly have done. The expert's face had put on a peculiar look—something like that of a workman's when he finds that a piece of work will do, after he has supposed that he had spoiled it. The expert assented.

"This is remarkable; I had that scheme ten years ago, and have carried a sketch of it all this time."

He took it out and placed it by the side of the one Waubug had. Both sketches were evidently by the same hand—that of the German. The two men looked earnestly at each other, but their earnestness did not spring from the same cause. Neither of them spoke. Waubug slunk away and did not return during the day. When they met again they agreed that the roof covered a brace of men that can prolong a good story, even though facts fail.

In the *Cosmopolitan Magazine* for October T. W. Higginson has an article on "Discontinuance of the Guide-board," one thought being the tendency of writers to omit the carefully drawn up moral or "guide-board," and leave the reader to form conclusions, or make up a moral, from data told by the writer. Other guide-boards could be discontinued, both in public places and in machine shops. At the entrance to the First National Bank and to the public library are doors opening only inward, with no handles on the outside. There are, however, plates on the outside engraved with the word "Push." This guide-board is absolutely useless, as a person entering can do nothing but push. As well might there be upon a stairway the word "Climb." How much good might be done with the money paid for these useless guide-boards throughout the world.

At the entrance of Gascon's drawing office I saw one day on a placard, in large black letters, the declaration, "We know that the gas is escaping." This evidently was to shut off those that thought the smell of gas was not already a sufficient reminder to every person in the office. It should seem that every one going into a place containing a stench would give the inmates the presumption of brains, and not even allude to it, but Gascon found it expedient to placard the acknowledgment, so that any business might begin at once.

Among the rules and regulations of a goodly-sized machine shop I see one directing that waste shall not be used in the water-closet. If I were employed in this shop I should feel like calling a meeting of the employes and take a vote to see whether we could not each and all forever do away with the need of such a rule, and then take another vote to ask that it be rescinded. I should not think that such a rule accorded me the presumption of brains.

Waubug's pleasant diversion is to bring up something that happened five or ten years ago, so as to hold a man up to ridicule when he is where others can hear. In this he exhibits a sure sign of approaching old age. Whenever a man begins to dwell more in the past than in the present, his powers are beginning to fail.

Before closing this series of papers I am persuaded to nail up one or two little guide-boards, not for the reader, but for those that the reader already has in mind, as they are the very ones that I wish to benefit. I do not expect that a guide-board will ever benefit Waubug Mephit. He is insensible to the ordinary influences that affect men. But I still have a little hope of Secretary, who, though happy in the contemplation of himself, still appreciates the difference between measuring with a knock-caliper and a micrometer.

To tell a designer that he ought to have thought of his late improvement ten years ago is about as sensible as it would be to tell him that he ought to have been born full-size. Most improvements are matters of growth—they do not announce themselves at once in full dress.

It is rather commonplace, if a man happens to be coming away from the shop at the time when the other men are going into it, to have one, two, or a dozen say: "You are going the wrong way."

Many of the old jokes that might have been funny once have become trite, and a machinist has no use for them. If one accidentally hits another's foot, we can hardly call it wit to say: "I must step somewhere." Too many repetitions are a waste of valuable energy. If a thing is perfectly clear to us, it may be ordinarily clear to others. We might give them credit for being nine-tenths as acute as we are, and not waste our energy by informing.

The facilities of the New York Post-office for handling second-class mail matter are at last to be increased—an improvement which has long been sadly needed, and which, when completed, will probably result in much less complaint from our readers of irregularity in receipt of papers.

A Southern contemporary, which modestly says it employs "more and better technical writers than any other trade journal published," has a prophetic article in which the running of engines by cold is predicted.

LETTERS FROM PRACTICAL MEN.

Journal Bearings—High-speed Engines.

Editor American Machinist:

I have just read the article by P. Pryibil, in your issue of January 5th, entitled, "Heating and Cutting of Bearings," and it is so to the point, and in line with the writer's experience, as to prompt the addition of further testimony.

The writer has been building engines (generally high-speed) for about eight years, and has also been called on to test and repair many engines—large and small, slow-speed and high-speed—and it has given the opportunity to observe many things.

In the days of slow or moderate-speed engines, the general construction, proportion of bearings, material of bearings, etc., were easily worked out, and in practice gave fairly good results; the structure was generally long and light (long stroke in the engine being the rule), bearings were as small as could possibly be, partly because designers did not dare to go too far, and because the structure, being more or less elastic, did not maintain its alignment when running, and large bearings then meant excessive heating. Often has the writer met engines running, and seen the engineer with troubled brow and a battered oil can wasting oil on a hot bearing, and heard the stereotyped exclamation, "I keep that bearing flooded with oil, but yet it keeps hot." Pencil and paper are produced, area of piston, and pressure, area of bearing, and speeds, are figured out, and bearing found to be carrying anywhere from 800 pounds per square inch up. In such cases how can it be expected to be otherwise; at every stroke of the engine the oil is squeezed out, leaving the metals to come in actual contact, and in babbitt bearings to compress the metal and spread it sideways until it grips between the collars, adding to the heating. This is no fancy sketch; in my experience it has been met much too often.

In these later days the high-speed engine and *very* high-speed engine, and also high and *very* high-pressure engines are in demand; these types date back comparatively a few years; the demand has been sudden and great; experience has not been able to keep pace with the demand, and designers have to a great extent been compelled to use the rules of their forefathers. The writer has met this statement in works on the steam engine: "Increase of surface means an increase of friction"; this is the barrier over which many designers have feared to climb. As a bare fact it is literally true, but with the modifications that modern intelligence is standing up against it, make it one of the elements producing the best results; we now find that increase of surface means a *decrease* of friction per square inch, decrease of weight as speeds are increased, smaller and more compact and rigid structures. These results necessarily went along with better workmanship.

Let us take two extremes, and let no one think this an exaggeration; the first has been met; the second is the product of a concern within hailing distance.

A great hole is excavated, an immense foundation is built, the engine placed on it and center lines placed, and the builder proceeds to set his engine in line with these light and easily moved centers on its backbone, the foundation; and he proceeds to put it together. We find the piston say 24" diameter, and 4" to 5" thick, the packing rings being nearly the total width of the piston; these rings are set out by a number of bolts with steel springs (?) under them; the piston rod passes through a stuffing box, in which there is just sufficient metal to support the packing, and the box is deep enough for about three turns of packing (more would increase the friction, and it is bad enough as it is), the shaft is put in place and everything seems to be in proper alignment, and ready to start; steam is turned on with a groan, because piston rings have been screwed out so tight and stuffing box drawn up to prevent leaking. It starts off and—stops on the center. A half dozen men with a 12-foot log and lot of timber pry it over the center. We get it started; we find the crosshead must run a little loose; the crank-pin and shaft spring slightly close up to the crank. After a few years the backbone (foundation) has settled a little, stuffing boxes and bearings have worn some little, and—well, let's see the other engine.

This engine is sent out, its backbone goes with it; its frame is built so heavy and rigid that all strains are absorbed within itself—it needs only enough foundation under it to keep the belt from pulling it around the room; there is no fear of its getting out of line if the foundation settles. It is set up in the shop, not by chalk lines tacked to the wall or on trustles, but by rigid centers within itself. Pistons are made as long or longer than their diameter, are light hollow castings with light sprung rings in them. Piston rods pass through long, loose sleeves, these sleeves being about one and a half times the length of stroke; crossheads are accurately fitted; the steam end of the engine so constructed that it is perfectly steam-tight, and the only friction in it being caused by the actual weight of the parts. Connections are made as light as is consistent with strength, and bearings exceedingly large, crankshaft of large diameter with generous bearings—all these of necessity are fitted up in perfect alignment, and last, but not least, a perfect system of continuous oilers keeps every bearing properly lubricated. This engine is now ready to start up. One man can take hold of the fly-wheel, and his own weight is sufficient to move it as wanted. Steam is turned on, and the engine starts 400, 500, 600 revolutions per minute, and—you can hear the clock ticking on the wall alongside of it.

Some wiseacres will say yes, but your high-speed engine won't live long; it can't stand that speed; it will soon hammer itself to pieces. But, my dear sir, the facts are against you; there are many high-speed engines to-day with large bearings and good proportion that stand up to their work in a way to surprise even their builders.

In the matter of fuel economy we will leave it to the reader to decide which of the two gives the larger proportion of power to the belt for the steam that enters the cylinder.

We may never be able to design a "one-hoss shay," but certain it is that that represents a perfection we are all aiming for.

Baltimore, Md. SAM'L T. WILLIAMS.

Engineers in the Navy.

Editor American Machinist:

In a foot-note to my letter published in your issue of December 22, 1892, I made some reference to the "Commodore Perry Board" for appointing engineers for the U. S. Steamer "Fulton," I did this off-hand, but find on referring to my books that I was in error—the date being 1837, fifty-five years ago, instead of fifty, and that Commodore Perry was in no way responsible for that exemption from corporeal (mind you spell that word right this time) punishment; he was no such man as that, but it is to be found in the letter of the Board of Naval Commissioners to the Honorable Secretary of the Navy, dated September 15, 1837, in the following paragraph:

"The engineers to sign some proper instrument which will legally render them liable to the laws for the government of the navy, but to be exempt from corporeal punishment, which instrument is to be transmitted to the Secretary of the Navy, with the letter accepting their appointment."

Corporeal punishment meaning (in those days) flogging with a cat, bucking, gagging, tricing up, the spread eagle, single irons, double irons, confinement in a hot coal bunker, etc. The sight of these things has often sickened and filled me with wonder that men can be so cruel to their kind, but they do get that way through an exaggerated belief in the value of military discipline.

My contention still is, however, that you will never see the time "when the principle *will be recognized* that naval battles will be contests in which the best machines, handled by the *best men*, will come off victorious," as the advance has been a minus quantity, taking into account the whole fifty-five years since Commodore Perry's letter, which I now send you in full, as a rather interesting bit of mechanical history.

I would note that Commodore, or at that time Captain Perry, had the appointment of commanding officer of the United States Steamer "Fulton," the second of that name.

New York, September 11, 1837.

GENTLEMEN: I have sought to obtain the best information in reference to the number of engineers, firemen, etc., that will be required for the steam frigate Fulton; and the following is the result of the combined opinions of the various persons consulted.

The lowest number for putting the engines in operation, two first-class assistant engineers, $800 per annum; two second-class assistant engineers, $500 per annum; eight firemen, at from $25 to $30 per month.

The firemen to be paid either of these amounts, at the discretion of the captain, as suitable persons can be obtained. Four or six coal heavers, at $15 per month; add to this, when the vessel is in active operation, one chief engineer, four additional firemen, and four coal heavers (that is for the full complement, one chief and four assistant-engineers, twelve firemen and ten coal-heavers).

The coal holes are at the ends of the boilers, opposite the furnaces, and the coal must necessarily be transported some distance.

These are the estimates of Mr. Kemble, Mr. Haswell, and several other competent persons with whom I have conferred on the subject.

It is apparent that no less than four engineers will answer, as it requires two constantly at the levers, by which the engines are stopped and put in motion, which are worked on the spar deck, and two at the engines and boilers below deck, to watch the machinery and attend the water in the boilers—a most important consideration, as by the least neglect in this particular some accident occurs or the boilers are burned.

It is necessary also that the firemen should be somewhat acquainted with the operations of the engines, the mode of supplying the boilers, etc., *as also the mode of placing the coals so as to prevent the burning of the furnaces.* (Captain Perry seems to have lost his grip a little at this point.)

The gentlemen all agree that the above is the least number that prudence and economy would authorize.

The large North River and Rhode Island boats have three engineers each, and their firemen understand stopping and starting the engines, regulating the steam, etc.

Their wages are: chief engineer, $1,000 per annum; two assistants, $360 and $600 per annum. Add to this their board, which, in the navy, would be defrayed by themselves, all beyond the ration of twenty cents per day.

Those denominated first-class assistants should for the navy correspond in qualifications with the chief engineers of private steamers, and their assistants with the second-class proposed for the navy, as it is supposed that the government can hire persons on lower terms.

It has been suggested—in which I fully concur—that there should be these several described rates among the engineers and firemen in our national steamers, the better to distribute authority and responsibility, and *to produce a proper ambition with the inferior rates to rise to the higher classes.* (A very proper sentiment.)

I inclose herewith a letter from Captain William Comstock, and it may be remarked here that all concur in the opinion of the necessity of separating the regular crew from any interference with the engines.

(But now he shows his fine Italian hand.)

I would respectfully invite the attention of the commissioners to the tenure by which these assistant engineers are to hold their appointments, and by what authority they are to be granted. It seems to me that the process of their discharge should be summary, at least, and entirely divested of the legal forms of arrest, court-martial, etc.

The *slightest appearance* of intemperance, neglect, carelessness, etc., should be a sufficient cause for their *certain dismissal* from the service. (The story goes that the chief ran away.)

With whom is to rest the authority to judge of these delinquencies, and the necessity of the infliction of the penalty, will, of course, be determined on in time, and made known to the persons on receiving their appointments.

I have the honor to be, gentlemen, your obedient servant, M. C. PERRY.

The Commissioners of the Navy,
Washington, D. C.

This is the Commodore Perry whose bra-en image may be seen at any time by peop-e in that neighborhood on top of the State of Rhode Island.

The peculiar merit which he claims, per inscription, being the opening of the ports of Japan in 1848.

The reason that the ports of Japan were opened so readily was that in their histories, which are written up a hundred or two years ahead (which is a much better method than ours), there was a certain "Shinn Toe," or "Ugly God," who was billed to appear about that time, and rule the country for a thousand moons. Of course there was no good in kicking against historical facts, especially as they found, when the Commodore exhibited himself to the people, that he exactly fitted the descriptive list, written a hundred years before.

I note that the chief in his report, as published in your paper, mentions the possibility of an engineer being called from important work "to answer calmly questions regarding the amount of smoke escaping from the funnels."

That this is not an exaggeration the following statement of an actual and recent occurrence will show.

The ships, four in number, of the squadron of evolution, were slipping comfortably along at about eight knots speed, being on a long run when the flagship signaled the next in line. Safety—valve—blowing. The captain, who was on deck at the time, began to think he was learning something, as he had not noticed any sound, but looking up at one of the pipes, sure enough there was a small show of steam. So the chief was summoned. Mr. Blank, "Do you need to have your safety valve blowing?"

"That valve is not blowing, sir; the steam pressure is not within thirty pounds of it. That steam you see there is from the leaky valve which I told you of three weeks ago as requiring attention, and being a new patent valve, I do not know exactly what is inside of it, and I want plenty of time before me when I start in to overhaul it."

"Well," says the captain, "there is not bunting enough in the fleet to convey that answer, and we have to give it soon; you say the valve is not blowing?" "Yes, sir." "And the admiral says it is, and I must not argue with the admiral with that show of steam at the pipe top."

So the answer went up, "I know it," and the admiral on his flagship ordered, "Stop it," and the answer was, "I cannot." Then the admiral, supposing that some disrespect to his rank, which was only "nickel-plated," or "acting," was intended, ran up the signals, "Commanding officer suspended from duty."

Then at the next port there was a heap of correspondence, and charges, and counter charges, during which, as by good luck, this engineer was not involved, so he used his time to quietly grind in that offending valve. The fleet and the navy department were stirred up for six months over this thing, and all because an acting rear admiral would meddle with trifling affairs; he had learned somewhere that it was not "good form" in the English service to show steam at their pipes.

In contrast with this I will give you a little yarn showing how these engineers do things sometimes when left to their own devices.

In the remarks column of the steam log of a United States double-ender a low-pressure paddle-wheel boat in the Pacific. 12 mid

night to 4 A.M.: "ran slow from 2.10 until 2.30, while stopping a leak in No. 1 furnace starboard boiler"; and this is the leak and how it was stopped.

At 2.10 A. M. the firemen and engineer on watch were startled by a tremendous rush of steam and water and fire and dust in this No. 1 furnace, produced by the breaking and blowing in of a ¾" rivet; instantly the engineer sent to the deck and informed the officer there that "he was going to run slow for a little while," at the same time closing the stop valve of the port or uninjured boiler, letting the safety valve take care of its steam. In a few minutes the pressure in starboard boiler was reduced to atmospheric or less, and the surprised firemen reported that the leak had stopped. "Drag out that fire" was now the order, and when it was well cooled off the front tier of fire bars came out also, and the engineer, stationing his oiler by the engine, which was still running at a good rate, to mind any bells he might get, jumped into the furnace with a ¾" tap, and a short bolt to match it, and the necessary wrenches, and the trick was very quickly done, the bars replaced, a new fire started from the other furnaces, the pressure equalized between the boilers, the stop valve opened, and full speed again within twenty minutes.

There was a considerable mental calculation, which went through this man's mind in a very short space of time; he knew that it was a ¾" rivet hole to be stopped; that a ¾" tap would go in; that the bolt would match the hole; that he could adjust his throttle so as to hold a slight minus pressure without doing too much in that direction; but, above all things, that he was favored by the night, which left him free from troublesome questioners; hence his quiet report to the officer of the deck.

A VETERAN NAVAL ENGINEER.

Measurement of Irregular Surfaces.

Editor American Machinist:

In the design of a special machine not long since the difficulty of ascertaining in a simple way the area of the surface of a very irregular substance presented itself, and thinking that the subject may interest some of your readers, I give the solution. I first obtained a rectangular piece of the same substance, the area of the surface of which could be readily ascertained.

I then procured a vessel of sufficient size and partially filled it with water, the depth of which was noted.

The piece of known area was immersed in the water and withdrawn, the surplus amount of water being shaken off and allowed to run back into the vessel.

The volume of water adhering to the substance was ascertained by a comparison of the depths before and after the immersion.

The irregular piece was next treated in the same manner, and the volume of water adhering to it likewise ascertained. Letting Q represent the area of irregular piece, A the known area of regular piece, V and V^1 the respective volumes of water adhering to each, we have

$$\frac{Q}{A} = \frac{V}{V^1}, \quad Q = \frac{A\ V}{V^1}.$$

Care was, of course, taken to have the surfaces of each clean and of the same normal condition.

A. S. MALLORY.

Steam-heated Cars.

Editor American Machinist:

In this day and generation, when the art of steam heating and the knowledge of health preservation are so well understood, it would hardly seem possible that such a condition of things could exist as that which occurs daily on some of the New York elevated trains. Arriving by the N. Y. & Northern R. R. at 155th street, the traveler emerges from a comfortably warm car, and, entering the elevated train, finds himself treated to a refrigerating process of the most extreme kind. The train is there fresh from its all-night exposure to the arctic cold of our latitude in midwinter, no attempt having been made to warm the cars previous to the entrance of the passengers. Consequently, while many of the strong men are able to bear such exposure, the more sensitive ones are exposed to a most dangerous chance of permanent injury, and delicate women are even in danger of their lives. I have seen people sit blue and shivering, and with chattering teeth, from this most unusual exposure. It seems to me paradoxical that New York should be the place where one may witness such a condition of things, for, after twenty years' observation, I had come to believe that we were ahead of other cities in matters of this kind. That the evil can be remedied is undoubted; whether it will be remains to be seen. The matter has been brought to the attention of the superintendent of the road, and hopes are entertained that something will be done. Our health officers could exercise their influence in no better cause than this.

T. R. ALMOND.

Annealing Chains.

Editor American Machinist:

Your readiness to give to others any hints in the line of the "practical" encourages us to mention one which was given to us recently by one of the practical men in our city.

He says that when his lifting chains about his shop begin to break he takes them and lays them on the ground in a coil, and then builds a fire in the center to anneal them. The result is that they are again ready for business. The philosophy of this course of action will be apparent.

CALLENDER & PATTERSON.

[Our correspondent makes a good point. Annealing chains has been practiced for years by those operating dredging machinery, but is not so generally known or practiced as it should be.—ED.]

A Side Tool—A Lathe Dog—A Soldering Fluid for Iron—Tap Wrenches.

Editor American Machinist:

In Fig. 1 on the inclosed sketch I show a little point on a side tool that I believe is worth notice. Who ever saw a side tool used to cut the whole length of the blade? The idea of this is to avoid grinding a part of the tool that never does work. Most side tools when worn out will be found to have been ground mostly on the point, because this is where it was in the habit of getting dull, and the average man does just as much grinding as will answer the purpose, and I am sorry to say that there are many more lazy than this.

I made a tool of this kind as an experiment a number of years ago, and was satisfied that my theory was correct. The average man is more apt to keep such a tool ground right than where the old style is used.

Some might object to this nick at *A*, on the ground that it will tend to weaken the tool, but I did not find any trouble in this way.

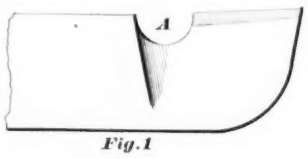


Fig. 1

Quite a number of years ago I made a lathe dog, as shown in Fig. 2. This was made for a special purpose. I had a number of small saw arbors to make at the time. There was but one saw collar, which was shrunk on the extreme end of shaft, to which the saw was fastened with countersunk head screws. With the ordinary bitch dog I was obliged to remove one of the screws in order to get the dog on the shaft back of this collar.

This dog was very handy on that job, and since then I have found it about as handy on most other jobs.

Used on a very small piece it does not balance well, but there are other good points about it that seem to more than offset this bad one. As the sketch shows, it is not much more than an ordinary gripe dog. *A* is a tail for the purpose of driving, used in a slot in face-plate in the usual way. *B* is made of tool steel, and hardened, one end being forked to slide along the back of gripe, as shown. *C* is a pin for the purpose of keeping the piece *B* in place on the point of screw. This tool is of value as an ordinary gripe, as well as a lathe dog.

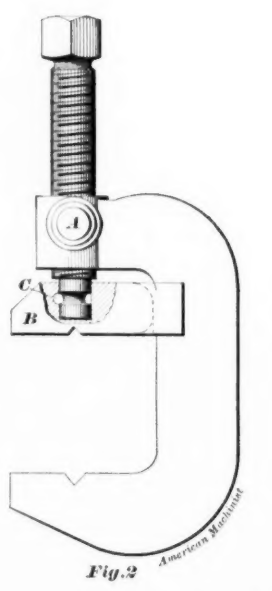


Fig. 2

I saw some time ago an opinion expressed that a tap wrench should accompany a set of taps, as well as a die stock should accompany a set of dies.

Before any new "wrinkle" comes into use very extensively, I believe there are in most cases some very deep-rooted notions that have to be pulled up by the roots.

The old idea of a tap wrench is a piece of flat iron with square holes punched in it by a blacksmith, but a die stock, in most cases, has been considered quite a fancy thing. This may be the reason why tap wrenches have not received proper attention.

I have seen the tap wrench making industry carried on in a way that would astonish some people.

In the shop where I served an apprenticeship there was "a place for everything, and everything was kept in its place," but such a place I have not seen since.

It was the largest single tool shelf I can think of ever seeing, for it comprised the whole shop floor.

People got into a habit of placing the tools around the edges, so as to use the center for a machine shop. This sort of practice at last resulted in getting things pretty well piled up, so it was thought to be a better plan to forge a new wrench when wanted than to look for one already made.

The boss had concluded, after a fair trial, that it was cheaper to keep the taps somewhere else than to make a new one every time, but the wrenches, being so easily made, were not worth the notice of so great a man as he.

Some of the workmen who looked so far ahead as to-morrow kept a tool room of their own in their drawer, so after awhile they went out of the wrench-making business; but there were wrenches made every day, and lost just as fast.

I came to the conclusion—as soon as I got the "lay of the land"—that it would be a good plan for me to start a little tool room in my drawer, so, as I wanted to do things different from others (if my way was worse I did not care), I thought I would try to improve my tap wrench system.

I made an adjustable tap wrench to take taps from ¼ to ⅝.

The boss caught me just as I was finishing the tool. I thought he was going to take it away from me, but guess he thought I would find use for it in the interests of the shop.

As soon as the wrench makers found out I had this tool, I got a chance to lend it. I would not have complained if they had brought it back when through with it, but the fact was they had got such a habit of keeping all tools on the big shelf that I had trouble in keeping this wrench in my tool room. Things that are easily made get lost rather too easy.

The adjustable tap wrench need not cost more than a full set of these losable ones, and, as they are better looking, stay longer with us.

I have often been bothered in soldering upon cast-iron, but a short time ago a tinsmith told me a way, and now I want to tell it to others.

I suppose people who are in the soldering business will not see anything new in this, but to machinists I think it may be of value.

Use muriatic acid full strength, and put into it as much zinc as it will cut. To a half pint add a piece of sal-ammoniac about the size of a walnut.

A MECHANIC.

American and British Workmen.

Editor American Machinist:

Your correspondent has reached the apex of fame by presenting to your American readers a little of what he would very much like the Britishers should be. I emanate from the "clumsy-fisted" Britisher, but am now one of those awaiting for three and one-half years the signal which the "freedom of individualism" in America invites me to "step up here"; but as I cannot bring the necessary dollar I fear my hope is a vain one, and I still may work hard at the bench, with the foreman ready to drop onto me for any little cause, because I happen to be a Britisher with an opinion. I have not made railroads or shipbuilding a special study, but I should judge from the remarks made it could only come from a narrow mind, with an eye capable of viewing things either "prosaically," or poetically, as desirable.

Of machines no one appreciates the milling machine more than I do, but, like most things, it has its own province of usefulness. The slotter may be referred to likewise. If Mr. Arthur will turn to the advertisements in the same issue in which his comedy is inserted, he will find such eminent and trustworthy firms as Wm. Sellers & Co. and the Niles Tool Works placing prominently their slotting machines to view; it is not unreasonable to suppose that these firms would offer their patrons nothing but what would be efficient. Mr. Arthur's evidence is rather conflicting. He speaks of the chuck which is made for American workmen who know how to use and handle them, but which are too light for the clumsy Britisher; of the difficulty such would find in moving a "little knob"; of the inability of such to operate a machine without the "stout lever," etc., and yet he finds three distinctly American machines in successful operation in that same shop, by the men who are incapable of comprehending the use of that "little knob." It is strange that the workmen had not boycotted these machines and made the British production the more efficient, as was assumed in the case of the "timed" slotter. Technical journals of America often refer to an inroad of American tools into England, and yet Mr. Arthur says the Britisher is incapable of working them. Scrap-iron must be scarce in Britain, if they have to purchase high-class American machines and keep their best-paid men to break them up.

With regard to gears, it took me eight days to grind the teeth of segment gears on an emery wheel in Chicago about three years ago. Would it be fair of me to tell my brother chips at home that this is American practice?

"Hopelessly a workman"? I had an acquaintance who was a pressman, but is now lecturer on scientific matters to one of the county councils. A school-fellow, now about twenty-six years of age, has a government situation in India, and is one of the most promising of the young scientists. Whitworth scholars have been mostly found among the hopeless workmen. Technical education is encouraged and costs scarcely anything. Among the students we find a large majority are the sons of workmen, and it is not an exaggeration to say they can compare favorably with the sons of American workmen in intelligence and information.

All Americans are not alike. The men who are most useful to the mechanical world, men whom Americans have reason to be proud of, and for whom Britishers have sincere respect, are the most reasonable and serviceable, and are the truer patriots, from whom we hear nothing sarcastic or abusive, nothing but kindly criticism with an object to elucidate facts. These men tend to cement two great nations for universal good, and place into insignificance pretenders to the crown of thought, yet whose shadow often shields the plotter in his wily motive.

The most surprising is that the editor who conducts such a valuable periodical as the AMERICAN MACHINIST is, after the comments on the treatment of Mr. Dredge in a recent issue, should allow such valuable space to be occupied in an effort to belittle that gentleman's fellow-workers in industrial Britain—an effort which cannot result in the least good to either country.

T. EDGAR PEARCE.

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Some Possible Elevated Road Reforms.

Just now, when the elevated roads of this city are moving for greater privileges, in order, as they say, to give increased accommodations, it is pertinent to inquire whether or not they are giving the best service possible with their present opportunities. A letter which we publish in another part of this issue throws some light on the question.

Railroads on which the cars are heated by steam from the locomotive, and where passengers must be attracted in competition with other roads, arrange to heat their trains by a stationary steam plant, and such a thing as letting the cars remain entirely unheated until the engine is coupled onto the train ready to start would not be thought of.

There are other things. Take the simple matter of making change. In other places where much small coin is handled, the cashier or ticket seller has before him a small rubber mat having little spurs of rubber projecting from its surface. From this mat small coins can be readily picked up by the fingers of one hand. This improvement is not used at the elevated road ticket offices, and, small as the matter may seem, it is important, when, as often happens, a long line of people are waiting, many of them with gloved hands and carrying parcels that prevent their using both hands.

Much delay is occasioned by misunderstanding of station names and the destination of trains. This could be avoided by having in each car a device which would show in plain letters the name of the next station, a small crank being worked by the guard to expose the proper name. A similar device on every station platform would show the destination of every approaching train in large letters that could be read from any part of the station. At present this is done by shouting, the sounds uttered having been likened to the password to a Chinese lodge.

Again, if patrons of the roads could know at what intervals or times trains ran on all the roads for all points it would be a great convenience, and would tend to more rapid working. The matter is too complicated for any one to remember, even those who travel most, and small condensed time-tables issued to patrons freely ought to help very much.

Then in the matter of lighting the cars, no Pintsch gas or gas of any kind is used, but simply antiquated, dirty, smoking and gloomy oil lamps.

The Manhattan Company is abundantly able to put in these and every other possible improvement, and if it made it evident that it was living up to its opportunities fully, it would probably be easier for it to obtain additional concessions.

It is not true, as the many railroad managers affirm, that there will be about so much kicking and cursing of a road any way, regardless of what the road does or does not do.

Inventor Traps.

No doubt many of our readers have acquired within a year or two the great and glorious title of "Honorary Member of the Parisian Inventors' Academy." One of the editors of this paper received, a short time since, a notice of his election to that exalted position, and was informed at the same time that by sending on the small sum of $10 he would receive a diploma and "great gold medal."

The miserable style in which the printed matter of this concern is gotten up, and the fact that the circular letter is not addressed by name, and does not specify any particular invention, but is gotten up in such general terms as to apply equally well to the case of any patentee whose name and address may appear in the *Patent Office Gazette*, ought, it seems, to prevent any intelligent person from being caught by this latest humbug, but it seems the "Academy" is able to do some business. Of course there is a pretense of examination of inventions, etc., but it is all so palpably humbug that we hope none of our readers who have been "elected" (a passive and unavoidable act) have been so foolish as to send $10—an active and avoidable exhibition of gullibility.

There are many traps laid for those whose addresses appear in the *Patent Office Gazette*, and a luckless inventor is immediately flooded with propositions of all kinds, nine-tenths, if not all the stuff being pure and unadulterated humbug. It is a safe rule never to pay out any money nor sign any paper without *knowing* just what you are to receive for your money, or what the purport of your signature may be.

Self-hardening Steel.

There is little doubt but that there is considerable misunderstanding among machinists regarding the use of self-hardening steel. It is quite common to resort to this steel where the ordinary carbon steel used in the shop does not stand well, or refuses to cut; then if the self-hardening steel does not work it is considered that every resource has been exhausted. The fact is, however, that while it is true that self-hardening steel will often do good work where the ordinary steel fails, or is unsatisfactory, carbon steel of high grade and high carbon can be and is made and hardened in the usual way, that will readily cut metals that no self-hardening steel can make any impression upon.

It is said a number of coarse files or rasps have been piled upon each other to a height of 12 inches, bound together with wire and drilled through from top to bottom of the pile without lubricant. This was not done by a drill made of self-hardening steel, nor of such common steel as is too often supplied by purchasing agents who give far more attention to discounts and commissions than to quality of the steel they buy, but by high-grade carbon steel made especially for use in such a test.

Mushet or self-hardening steel is all right in its place, but there are places for which it is not adapted, and it is best, both for makers and users, that the proper place and uses of the different kinds of steel should be understood.

American Machinery Shipped Direct to Africa.

Mellin S. Harlow, M. E., of the firm of Manion & Harlow, managers of the South African Branch of the Ingersoll-Sergeant Drill Co., recently called upon us to make some inquiries regarding some articles for shipment to Africa, and informed us that about the 25th of this month a steamer would sail from the port of New York loaded with American machinery (principally mining), which was to go direct to Africa—the first shipment of that character ever made in this way. Of course there is a great deal of American mining machinery in Africa, but it has previously reached that point by being re-shipped from England. Mr. Harlow expects to sail on the steamer with the machinery, and will be at Johannesburg, S. A. R., for about a year.

That "Extinct Hack Saw."

In our issue of Nov. 10 last year, under the title of an "Extinct Hack Saw," we asked for information regarding the manufacturers of a certain hack saw which we described, and which one of our readers was very anxious to buy, but declared his inability to buy in New York City.

We have received numerous letters informing us of the name of the saw, and where it can be obtained. Many of these writers were mistaken, but others were right, and these latter enabled us to find the saw at the store of C. E. Jennings & Co., 79 Reade street, this city, who control the product of a factory somewhere in New Hampshire in which the saw is made.

The incident seems to show two things, *i. e.*, the advisability of having somewhere on a manufactured article the name of its manufacturer or his representative, and also the advisability of advertising even what is supposed to be a well-known article It might be argued, of course, that everyone should know the Griffin hack saw, but there are thousands of mechanics who do not know of it, and who, even if they actually use it, may not know it by that name, because it is "published anonymously," as it were, the name printed on the box not counting for anything after the box is lost or destroyed.

We publish elsewhere in this issue an illustrated article showing an arrangement for a combined exhaust and live steam heater for boilers. Without entirely indorsing the arrangement—which is not new except as to details—the writer has always been of the opinion that economy resulted from heating water in some such way. This belief cannot, perhaps, be defended upon any course of scientific reasoning. Theory would be all against it. But theory sometimes fails as seriously as practice fails. Our readers will draw their own conclusions, which should not be too hasty.

It will be noticed that the claims are not for enormous saving. If, however, these claims are correct, they are of sufficient importance to receive consideration.

The article stands subject to intelligent criticism, which we have little doubt it will receive.

It is announced that the first of the social reunions to be held at the house of the American Society of Mechanical Engineers this season will take place the evening of Jan. 26. The feature of the evening will be the projection upon a screen of lantern slides made from negatives secured during the California trip. A modest supper will be served at 10 o'clock. As we have before stated, the moderate expense attending these reunions is borne by those who attend them, and their influence upon the society is believed to be beneficial, since they promote acquaintance and good feeling among the members and their friends.

Last week, in mentioning the matter of Kearney & Foot's file chart, we, by mistake, located that well-known firm in Newark, N. J., and in part of our edition it was thus printed. Most people who use files know that their factory is in Paterson, N. J., and their New York offices at 100–102 Reade street, where the chart may be obtained.

Literary Notes.

ELEMENTS OF MACHINE DESIGN. Notes and Plates, for the Use of Students in Lehigh University. By J. F. Klein, Professor of Mechanical Engineering. Second and Revised Edition.

This work treats on designing the most important parts of machinery, and embraces the solution of such problems as occur in practice. The proportions are either inscribed on the plates or are given by formulas and tables; the dimensions are to be calculated in all cases from data given in the text. The various chapters treat on screw threads; conventional method of representing screws, set screws, methods of securing nuts, rivets and riveted joints for wrought-iron boiler plates. Keys for pulleys, wheels, cranks, etc., gibs and cotters for connecting straps with rods. Exact and approximate methods of laying out curves of teeth, profiling of teeth by rectangular co-ordinates, computation of these co-ordinates; Toothed gearing, laying out wheel trains, dimensions of spur wheels; Problems in ascertaining minimum pinions and duration of contact, and in laying out annular and elliptical wheels; Dimensions of bevel gears; Dimensions of worm and worm-wheel; Belt gearing: Dimensions of belt pulleys, cross-section and specific duty of belts; Cone pulleys: Diagram and tables for determining the diameters of speed cones when connected by open belt; Rotating pieces: Dimensions of end journals, neck journals, pivots, shaft and shafting; Bearings: Their character and dimensions; Dimensions of rods, with circular, rectangular and I sections; Co-ordinates for laying out cycloidal, involute, epi- and hypo-cycloidal profiles; and for laying out center lines of tooth spaces.

Since many proportions are inscribed on the plates, these form an important part of the book, and it is therefore necessary that

the symbols should be very plainly given; in this we find the present edition to be greatly improved; the drawings and the symbols have been enlarged, the latter on a larger scale than the former, thereby removing all the indistinctness of the earlier plates.

The book is well adapted for reference, so as to be an aid to draftsmen and engineers, and for use in the drawing rooms of technical schools, and will be appreciated by all who have to refer to its pages. It is published at the Moravian Publication Office, E. G. Klose, manager, Bethlehem, Pa. Price not given.

CYCLE-INFANTRY DRILL REGULATIONS.—This is a small book published by the Pope Manufacturing Co., Boston, giving the drill regulations and other information relative to the use of the bicycle in military operations. The regulations have been prepared by Brig.-Gen. Albert Ordway, and regularly adopted March 25, 1892.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(30) H. R. W., Gualala, Cal., writes: Please answer the following: 1. Does lost motion in the side rods of a locomotive produce a knock? *A.*—If the lost motion is excessive, yes. 2. Is it easier for an injector to feed water through the back end of a boiler than through the front end? *A.*—No; the feed water should enter into the coolest part of the boiler.

(31) P. H., Scotia, Cal., writes: Please inform me how to go to work and babbitt, the crankshaft bearings of a double vertical engine so as to make a good job of it and get the shaft in line with both engines. These are connected to crank disks on each end of the shaft, with one crank-pin 90 degrees in advance of the other. By giving me some information on this subject you will do me a great favor. *A.*—See our issues of August 13, September 10 and 17, 1891, and February 11, 1892.

(32) J. J. P., Newport News, Va., writes: Please state the correct formula for preparing the solution for blue-prints. I know that the articles used are citrate of iron and ammonia, and red prussiate of potash, but I have forgotten the proportions for each, and the amount of water. *A.*—Dissolve 2 ounces of citrate of iron and ammonia in 8¼ ounces of water; also dissolve 1⅛ ounces of red prussiate of potash in 8¼ ounces of water; when they are dissolved mix them in a dark bottle, and keep it in a dark place for future use.

(33) A. M., Ashland, Wis., writes: I have seen in your paper a formula for the composition of babbitt metal. I would now like to have a formula for the cheaper kinds of this metal. *A.*—There is but one kind of babbitt metal, and if any alloy is either much better or much worse than that, it is not babbitt, but something else. One of the cheaper kinds of the so-called babbitt metal consists of eight parts of lead to one of antimony; the better grades contain less lead and more or less copper and tin; the real babbitt metal has no lead; it consists of 3.7 parts copper, 7.4 parts antimony, and 88.9 parts tin.

(34) E. H. F., Worcester, Mass., writes: Please inform me whether it is possible to bore an elliptical hole with a boring bar between the centers of an ordinary lathe. The piece to be bored is to be fastened to the carriage and traversed along the bed as usual, and the tail stock to be set over to any extent. A friend who is an old-time machinist, and derides geometry, says it cannot be done. I claim it can, and have deduced the following formula which I wish to be informed about:

$$L - S = L \times \textit{vers. } a;$$

where L denotes the long diameter of the hole; S the short diameter, and a the angle formed by the boring bar and the center of the lathe bed. *A.*—Elliptical holes can be bored under the conditions stated. Your formula gives the correct difference between the major and minor axis. In our issue of January 17, 1889, this subject has been thoroughly discussed, and in this article you will find other useful formulas.

(35) A. S. W., Philadelphia, writes: I have devised a machine for automatically drilling and tapping nuts like the inclosed, which are used chiefly in saw manufacture. Please note that the thread in the nut is not all the way through. I would like to know if the machine can be used for any other line of work? *A.*—It depends much upon the design of the machine, which, being unacquainted with, we are at a loss to answer definitely. Having designed the machine you are naturally the best person in the world to investigate and decide this matter. Look about for similar work which is already done, and then consider whether or not your machine can do it, and, if so, what modifications, if any, will be needed. Then also determine whether or not the work is already done cheaper than you can do it with your machine.

(36) W. T. G., ——, asks: How is the lead of a hardening bath prevented from sticking to a tap or reamer? *A.*—It can be helped by first immersing the article to be hardened in soft soap. Or before doing this it may be previously partially heated. Or you may use the solution given by Mr. H. B. Hungerford, in our issue of September 17, '91. This is: equal parts of wheat flour and common fine table salt mixed with water to make a thin paste and thoroughly stirred up. Dip the articles in this, taking pains to keep it well stirred up, as the salt has a tendency to settle to the bottom. 2. What is the solution which is used on taps and reamers by some makers in tempering, which gives them a grayish or case-hardened appearance? *A.*—This may be done by using for a bath equal parts of cyanide of potash and common salt. This can be heated and used for heating the articles, and can also be heated by a thermometer for drawing the temper. Where the temper is drawn in the usual way, so that the temper color is present, this may be removed by dilute muriatic acid.

(37) H. S., Newark, N. J., writes: A. claims that in figuring speed the thickness of the belt should be added to the diameter of the pulley. B. claims that it should not be. Which is right? *A.*—The whole thickness of the belt should never be added, but a part of its thickness should sometimes be added, whether it should be or not depending upon circumstances. Belts, owing to the fact that they are compressed at their under surfaces and stretched at their outer surfaces in passing over pulleys, have what may be called a pitch line, and which may be taken at two-fifths the thickness of the belt measured from the pulley. If the pulleys over which the belt runs differ greatly in size, and, accurate speed is required, this must be taken into account, especially if one or both pulleys are small in diameter, so that the amount added is a considerable percentage of the diameter. But where the pulleys are the same size, adding the same amount to each will not affect the result, and unless the variation between them is considerable in proportion to the absolute diameter, it may be neglected.

(38) E. J. B., Phila., writes: In copy of July 18, 1889, Prof. Sweet, in speaking of his 16 lathe, mentions a plan of lead screw for screw cutting, "using a short screw 8" or 10" long with a nut of the same length, the screw to be adjustable at any point along a splined rod." As I understand this arrangement it would only cut screws equal to or shorter in length than the sleeve on which the lead screw is cut. Was that the idea of his plan, or were there to be other parts, so as to cut full length of lathe? *A.*—Prof. Sweet's idea in this is to provide a means of cutting nine-tenths to ninety-nine hundredths of all the screws a lathe is ever required to cut, and to do it more accurately than is possible by the usual lead screw and nut; lathes with ordinary long lead screws being used for cutting screws longer than can be cut by this device. We may add that recently in conversation Prof. Sweet informed us that he had never done anything in his shop that gave him better results than the adoption of this device on some lathes in which his crossheads and piston rods are threaded, whereby the pitch of the screws cut is kept accurate, and the great trouble formerly experienced from the fact that they could not be kept accurate, avoided.

(39) E. T., Newark, N. J., writes: Kindly give us some information relating to the following: How is the horse-power of an engine measured by means of a brake? What weight has to be used, what should be the diameter of the wheel, and what should be the length of the arm? *A.*—We assume that you refer to a Prony friction brake. This primarily consists of a lever, one end of which is formed so as to be clamped to the engine shaft, or to a brake pulley fastened to the shaft, or in some cases to the fly-wheel of the engine; at the opposite end of the lever, weights are suspended, to balance the friction induced between the surfaces of contact at the shaft end. The friction will tend to rotate the lever in the direction in which the shaft revolves, but the weights attached to the end of the lever should be such as to prevent rotation and hold the lever in a horizontal position. The length of the lever is measured from the center of the shaft to the point from which the weights are suspended; let us denote this distance in feet by L; also let us denote the sum of the weights in pounds by P; the work of the shaft in foot-pounds per minute by W; the velocity in feet per minute of the point from which the weights are suspended, if the lever were allowed to rotate with the shaft, by V; number of revolutions by N; the horse-power by $H.\ P.$, and π the ratio of the circumference of a circle to its diameter; its value is generally taken at 3.1416. Now the work of the shaft is found by the following formula:

$$W = P \times V;$$

but since V is equal to $2 \times \pi \times L \times N$, we may write:

$$W = 2 \times \pi \times L \times N \times P.$$

If, for instance, the length of the lever (L) is 3 feet, and the shaft makes 125 revolutions per minute, and the sum of the weights attached to the end of the lever is 500 pounds, then we have:

$W = 2 \times 3.1416 \times 3 \times 125 \times 500 = 1{,}178{,}100$ foot-pounds for the work of the shaft, and this is equal to $1{,}178{,}100 \div 33{,}000 = 35.7$ horse-power. In this case we have assumed that the weight of the lever has been counterbalanced on the shaft, so that this weight need not enter into the computation. It will be noticed that the diameter of the brake pulley has not been taken into account, and so far as theoretical considerations are concerned we can make it any diameter, the result will always be the same; but practical considerations frequently restrict the diameter of the brake pulley, and also the length L of the lever within given limits. The following table gives suitable dimensions for Prony brakes:

	Number of Revolutions Per Minute of Brake Pulley.	Size of Brake.		Diam. of Brake Pulley.
		Length	Width.	
From 2 to 5 H. P.	1,200 to 1,800	24″	1½″	4″
	700 to 1,200	24	2⅜	6
From 5 to 8 H. P.	1,200 to 1,600	24	2⅜	6
	800 to 1,200	24	4	6

A modification of this brake, in which the lever acts on a platform scale, is shown in our issue of March 8, 1884. In this case, for engines above 125 horse-power and under 250 the brake wheel is frequently 48 inches diameter and 24 inches face, with internal flanges about 3½ inches deep, carrying a stream of water about 2 inches deep fed by a ½-inch pipe, the overflow being removed as shown in the figure, by means of a scoop pipe; the brake arm is 63 inches long. For smaller engines a brake wheel 48 inches diameter by 13 inches face is used, and a lever 27¾ inches long. If the length L of the lever is equal to $\frac{33}{2\ \pi} = 63.024$ inches, practically 5 feet 3 inches, a value often used, the formula for finding the horse-power is much simplified, as follows:

$$H.\ P. = \frac{N \times P}{1{,}000},$$

in which the symbols denote the same quantities as before.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's Gear Advertisement is always on page 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes Mer. Mach Tool Co., Meriden, Ct.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

New lists of cutters. Brown & Sharpe.

Norway Rivets, Evans & Robertson, Cincinnati, O.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for standard Tool Co.'s Twist Drills.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Castings for small and medium sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., corner Canal and Washington Sts., Chicago, Ill.

Combination Gear Cutters in stock. Vertical Miller, Drill and Slotter in one machine, worth its weight in gold. R. M. Clough, Tolland, Conn.

We electrotype illustrations and advertisements for manufacturers. Prompt and thorough service. Send for estimates. A. Mugford, Hartford, Conn.

Roper's Practical Handy-Books for Engineers & Firemen; Descriptive Catalogue mailed free. Edward Meeks, Pub., 1612 Walnut St., Philadelphia, Pa.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief: History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles: the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Gilbert's "De Magnete."

We publish below some letters which will be self-explanatory. The first of these appeared in the *Electrician*, of London, Dec. 9, 1892, and is as follows:

SIR: My attention has been drawn to the paragraph in your American Notes on p. 135, in which there is a statement that a translation of Gilbert's "De Magnete" is about to be brought out in the States, and which further refers to the Gilbert Club, of which I have the honor to be one of the secretaries.

I think your American correspondent must be under some mistake in attributing the proposed translation to Mr. Mottelay, who is an honorable gentleman. He visited me at my laboratory rather more than a year ago, when we talked of Gilbert and of the Gilbert Club and its long cherished work. He then begged me to enter his name in one of the then few remaining places in the list of the members, that in due time he might receive the copy of the English translation of "De Magnete." He is not the man to lend his name in an underhand way to an attempt to depreciate the careful work that has been going on for three years by the editing committee of the club.

As to this alleged American translation, it is quite enough for most persons to know that its publishers are to be Messrs. J. Wiley & Sons, of New York, who have earned for themselves evil notoriety by their pirated editions of Ruskin's works. The Gilbert Club may well ignore anything emanating from so tainted a source.

As to the last part of your correspondent's paragraph, which relates to the affairs of the Gilbert Club, I will only say that down to the present time the club has not asked for a single subscription from any of its members, nor will it do so until its translation of "De Magnete" is ready for distribution. All the preliminary expenses of its foundation have been met without yet calling on the treasurer. It is true that a very few of the members spontaneously remitted their guinea apiece; and these subscriptions remain intact, awaiting the day of publication. The delay which has arisen since the first rough translation was completed two years ago has been due solely to the labor of revision. But the Gilbert tercentenary does not occur till 1900, and the work will be published within a few months from the present date. Yours, etc.,

SYLVANUS P. THOMPSON.
Morland Chislett Road, West Hampstead, N. W.

The following letter also appeared in the same journal:

Gilbertiana.

To the Editor of the Electrician.

SIR: Prof. Sylvanus P. Thompson has seen fit to publish a letter in your columns as remarkable for its inaccuracy as for its bad taste, and I will be obliged if you will afford me space to correct the former, the latter being his own affair.

Mr. Thompson appears injured because a hard-working and singularly erudite American is publishing a translation of "De Magnete," the only conceivable reason for this emotion being that such a publication will make more ridiculous than they are at present the hitherto sterile pretensions of the "Gilbert Club," about which such a fuss was made some years ago by Professor Thompson. Since when did this abusive gentleman possess an international copyright in "De Magnete"?

The following facts may be of interest: Last autumn Mr. Mottelay came to consult

me as to the course he should adopt with regard to the richly annotated translation he had made of Gilbert's work. He was divided between two opinions. He hesitated to do what he thought might interfere with the vague intentions of the "Gilbert Club," and he was very reluctant to allow injustice to be done to the "De Magnete," a result he feared would inevitably follow, owing to what he considered Professor Thompson's surprising want of knowledge on the subject.

I strongly advised him to publish, urging his absolute right to do so; the folly of allowing the great labor he had devoted to the subject to be wasted; the apparently doubtful, and in any case the limited issue of the Gilbert Club programme, and, taking his statement for granted, the imperfect character of the translation if it ever were published. Mr. Mottelay decided to follow my advice, and Professor Thompson may therefore look to me as being primarily responsible in the matter.

The reputation of Messrs. Wiley & Sons needs no defense at my hands against the scurrilous attack of Professor Thompson. They rank as high as any publishers and gentlemen in the world. It is true that they published several American editions of Ruskin's works; and it is also true that they exhausted every possible means to pay a royalty on these works, and only abandoned the attempt when, after many years, Mr. Ruskin refused to negotiate.

Prof. Thompson may learn more of the standing of Messrs. Wiley & Sons if he ventures to attend the Electrical Congress at Chicago next year.

(Signed) JAMES DREDGE.

London, December 21.

We have also the original of the following letter, but are not informed whether or not it has appeared in the *Electrician:*

To the Editor of the Electrician.

DEAR SIR: I am indeed very sorry that my friend Prof. Thompson deemed it advisable to give publicity to the letter which appeared in your issue of 9th inst.

Prof. Thompson is often referred to in my class of experimental physics as an authority on methods of winding electro-magnets, on measuring the number of magnetic lines that thread through a given circuit, and, I may add, on dynamo-electric machinery in general; but I am sorry to say that his letter has led me to conclude that he sometimes allows his pen to run in advance of his knowledge. In a man with any pretensions to science this is hardly pardonable.

If Prof. Thompson had known the negotiations that took place between Messrs. Wiley & Sons and Ruskin's publishers; if he had known the offers made by the great New York firm years before any copyright law was concluded, he would not have made such statements in his letter about Mr. Mottelay's translation of Gilbert's "De Magnete" and his American publishers.

May I say, sir, that several of my pupils and friends—interested in the great work of Dr. Gilbert—have frequently asked me during the past two years what is, or what may be, the probable period of incubation of Gilbert's great work? Doubtless Prof. Thompson has carefully diagnosed the case and will be good enough to enable me to give an answer to my class after the Christmas holidays. I am, sir,

Yours very truly,
M. F. O'REILLY, D. Sc. Lond.

Tooting College, Dec. 20.

A New Gun.

A successful test of the Garland rapid-firing machine gun was made yesterday afternoon, near Logan Station, on the Reading Railroad.

The test, which was simply to show the deadly use to which the gun could be put, was made in the interest of several Philadelphia capitalists, who contemplate buying the patent and manufacturing the gun in this city, and who invited some well-known military men to witness the trial.

The gun, which is said to be the most rapid-firing piece of artillery ever made, was first put through a "dummy" test by the inventor, F. M. Garland, who explained in detail its mechanism. The piece is simple in construction, light in weight, and can be manipulated by three men, who can, it is claimed, explode from it 1,000 shells a minute.

The gun consists of two ordinary steel rifle barrels, incased in a gun-metal shell, the barrels being surrounded by water cases to keep them, while in use, from becoming heated. The machinery sets back from the barrels, being entirely disconnected and free from heat.

The feeding mechanism consists of a pair of wheels, having pocketed peripheries, mounted upon shafts on each side of the shell barrels, the shafts being connected with and alternately rotated by the driving shaft, with guides adjacent to the feed wheels, adapted to receive the heads of the cartridges as they pass from the wheels, and combs attached to the shell adjacent to the wheels for stripping the cartridges from the belts. The gun is fed on either side by ammunition belts containing fifty-five cartridges of 40 caliber, with cups for firmly grasping the cartridges, open on one side, so that the cartridges may be removed therefrom laterally, and provided with projecting wings on the edges, to afford a bearing for the cartridge-removing device.

The gun is so arranged that one or both barrels may be used, and, in event of one barrel becoming defective, it will not interfere with the action of the other. By a lever in the rear, it can instantly be moved into any position by the operator without stopping the firing. The firing lever is located at the extreme end of the gun, on the right side. The piece is mounted on a tripod, the weight of which is about sixty-five pounds, while the gun proper weighs eighty-nine and one-quarter pounds. The first test of the gun was with 300 cartridges, which were exploded in twenty-three seconds, and this was followed by a test of 600 shells in thirty-eight seconds. It is claimed that the piece can be used effectively at a distance of one and a half miles.—*Philadelphia Ledger,* Dec. 20.

Hardening Milling Cutters—Copyists.

In a little pamphlet issued by Lister & Company, of Keighley, England, which relates to milling machines exclusively, we note the following regarding milling cutters: "These should be of high-class steel; some of the Sheffield houses will now undertake to harden any cutters made from their steel free of charge, taking the risk." It occurs to us that this might be a popular plan for some of our American steel makers to adopt, and might save considerable annoyance to both makers and users of steel for milling cutters.

The same pamphlet has this to say regarding patents and copying of designs: "We have not adopted the prevailing fashion of patenting every point of our machines in order to protect our prices. We believe that the best protection we can have lies in our workshop organization and management, and in the quality of our workmanship and material. Again, we do not protect ourselves against copying of our designs; we look upon copyists as being devoid of original ability, and as being the last people who would adopt our special workshop system, without which their competition will be of no significance."

An apprentice in a machine shop sends us an original "verse of mine," and hopes we may find room for it. We could find room for it, but think it is better to use the space in advising this and all other apprentices in machine shops to aim to be either good poets or good machinists, for it is morally certain they cannot be both, while by trying it the chances are that they will be neither.

Some of the transatlantic steamship lines are threatening to increase the rates for cabin passage if the importation of emigrants is seriously interfered with by this government. They can, by concerted action, make some trouble in this way. But it is questionable if they will make much money by the operation. It is inferred by writers on this subject that, in the event of the price of passage being raised, American lines will spring up in competition. Those who write in this way appear to forget that, when the occasion comes, it will be as easy to reduce rates as to raise them when there is an opportunity. The question is as to whether American-built and American-manned steamships can compete with foreign lines, the stockholders of which are satisfied with a low rate of interest on their investments. The matter will not be settled by the course the transatlantic lines may take just now in the way of raising the price of cabin passage. The question—so far as the establishment of American lines goes—is as to whether American-built and American-manned lines can be operated so as to bring in returns that will suit the investors when in competition with the long-established foreign lines. Americans do not understand the getting along with passengers in the way of "tips" as our European brethren do, and would naturally pay more in the way of wages than are paid on European lines.

MANUFACTURES

The Paisley Woolen Co. are erecting a new mill at Mansfield, Pa.

It is stated that two paper-mills are to be built at Whippany, N. J.

The Kent Woolen Co., at Centreville, R. I., will erect a new building.

W. F. Remppis & Co. are enlarging their iron works at Reading, Pa.

The new American Bedstead Co., of Westboro, Mass., has organized.

The Estep Window Glass Co., Marion, O., will erect a 12-pot factory.

The Cohoes (N. Y.) Tube Works, recently burned, will be rebuilt at once.

A factory to manufacture knitted goods is being erected at Dover, Del.

The burned Van Bergen Iron Works, at Carbondale, Pa., will be rebuilt.

The planing-mill of the Donald Lumber Co., Mobile, Ala., will be rebuilt.

The Hardware Manufacturing Company of Golden, Col., will build a new foundry.

The Pontiac (Ill.) shoe factory will enlarge its capacity this year to 1,000 pairs a day.

The new factory of the Brockton (Mass Last). Co. is to be four stories high, 200x35 feet.

The United States Car Company, Anniston, Ala., is erecting a mill to make merchant iron.

Recently the Heinickle-Flegel Lithographing Co., St. Louis, Mo., increased its capital to $50,000.

The new car shops of the St. Louis Southern Railway Co. are to be located at Pine Bluff, Ark.

The Eubank Car Door Co. has been organized at Little Rock, Ark. The capital stock is $100,000.

Improvements at the cotton plant of M. Heywood & Co., Fall River, Mass., are under consideration.

Buck's Stove and Range Company are putting up a six-story addition to their works at St. Louis, Mo.

Greenslade Brothers will immediately rebuild their architectural iron works at Milwaukee, Wis.

A company to manufacture spring motors is being incorporated at Birmingham, Ala., by C. A. Loring.

Josiah Holmes will erect a rolling-mill, 60x32 feet, in connection with his foundry at Cumberland, Md.

The Klein Wall Paper Co. has been organized at Cincinnati, O. The capital stock is $10,000. A start will soon be made.

More than $15,000 has been subscribed to the stock of the new Chipman, Calley & Co. shoe company at Rockland, Mass.

The foundations are completed for the new Bessemer steel plant being erected in McKeesport, Pa., by the National Tube Works.

The Pennsylvania Railroad Company is considering the building of 5,000 freight and passenger cars, for which contracts will soon be awarded.

The Peckham Motor, Truck and Wheel Company is enlarging its shops at Kingston, N. Y. The force has been increased and work is carried on day and night.

Richards Balanced Engine Company, Portland, Me., has been incorporated, capital, $500.000, for manufacturing and dealing in locomotives, engines, cars, etc.

Morris & Berkley, Philadelphia, Pa., write us that they succeeded the firm of Morris Machine Co. on October 1, 1892, and desire this to be understood, to avoid confusion.

The movement toward the re-establishment of the shoe manufacturing industry in Waldoboro, Me., resulted in a public meeting at which $1,700 was subscribed.

The new works of the J. C. McNeil Boiler Company, Akron, O., will be erected at once to replace the works recently burned, and will be in operation inside of 50 days.

E. P. Walker, of Vinalhaven, Me., has purchased a hundred-acre wood lot near Perry's Creek, in Rockland, Me., and will erect a mill and engage in the manufacture of barrel staves.

Preparations for building the new whaleback, at Everett, Wash., are now going on at American Steel Barge Company works. Orders have been given for constructing a building 80x380 feet.

The Lobdell Car Wheel Co., Wilmington, Del., will erect a new machine shop. The building will be 67 feet in width, divided into a central portion 25 feet in width, with a wing on each side 21 feet in width.

The American Aluminum Company have about completed the plans for the erection of a twenty-five-ton plant in St. Louis, Mo., and in a few days will place contracts for buildings, steam plant, etc.

The Georgia, Carolina & Northern Railroad Company (office, Athens, Ga.) has agreed to build railroad shops at Abbeville, S. C., in consideration of the donation by the citizens of a site and a bonus of $15,000.

The "W. & S." Hydraulic Machinery Works, New York, have issued a catalogue showing their large line of lifting jacks, which will undoubtedly be of especial interest to mechanics. The illustrations are quite complete.

Terre Haute, Ind., anticipates the early erection of a large stove foundry. E. J. King, the Townley Bros., and B. F. Harrison, of Evansville, are the projectors. The annual output is estimated at 15,000 to 20,000 stoves.

A stock company has been formed at Peru, Ind., with a capital stock of $21,000, to manufacture grain drills. Among the parties interested are Milton Shirk, R. A. Edwards, Geo. C. Miller, Geo. W. Blue and G. G. Manning.

The Empire Carbon Company will erect in St. Louis, Ill., shortly, two mill buildings, each 83x1[illegible] feet, and three stories high. In addition to these will be an engine and boiler house, tanks, etc. The outlay will be between $30,000 and $40,000.

The Mount Battie Woolen-mill, Camden, Me., is fast nearing completion, and when finished will give employment to several hundred hands. An electric plant with a capacity of 300 incandescent lights has just been installed in the mill by Swan & Lane, of Boston.

The Bushnell Spring Company, of Poughkeepsie, N. Y., has decided to locate at Easton, Pa. A Pennsylvania charter has already been granted, with a capital of $50,000. A brick building, 50x400 feet, will be erected at Odenweiner, to be occupied February 1.

The McGlinchy brewery, in Portland, Me., which has been unused for a long time, has been sold to Isaac C. Atkinson for manufacturing purposes. Work will be commenced at once putting the walls and the boilers and steam heating apparatus in order for use.

The Weisel & Vitter Iron and Machine Manufacturing Company, Milwaukee, Wis., whose plant was destroyed in the recent fire, will rebuild on a larger scale. The capital stock has been increased to $200,000, and about $75,000 will be expended in erecting the new buildings.

The Canton Steam Pump Co., formerly of Canton, Ohio, have removed their works to Dixon, Ill., and have been re-incorporated under the name of the Miller Steam Pump Co. The company at Dixon is practically the same as the former one at Canton, only in removing its name was changed.

G. W. Jordan, manufacturer of lathe and planer Chucks, Worcester, Mass., writes us: The sale of my planer chucks during the year 1892 was very satisfactory and have a good number of orders for '93, and prospects are that '93 will be far better than '92. Prices for '93 a little lower than '92.

The steam saw-mill of A. H. Chadbourne at East Waterboro, Me., was burned recently. Fire caught from a spark from the chimney, and the mill stock was destroyed. The mill furnished employment to about twenty men. Mr. Chadbourne reckons his loss at $2,500, and has an insurance of $750. He will rebuild at once.

The Lodge & Shipley Machine Tool Co., of Cincinnati, O., have purchased the drawings, patterns, good will, etc., pertaining to the gear cutting engine and automatic gear-cutting machines heretofore manufactured by the Newton Machine Tool Works, of Philadelphia, and illustrated in the catalogue of the latter concern on pages 25 and 26.

The new bridge and iron works at Milwaukee, Wis., which will double the capacity, will consist of a main rivet shop, 300x300 feet; machine and blacksmith shop, 80x300 feet; forge shop, 80x100 feet; wood-working shop, 70x150 feet; office building, 50x100 feet. The output will amount to approximately 10,000 tons per annum, and will consist chiefly of the heaviest class of railroad bridge work, etc.

Preliminary arrangements have been made by Cofrode & Saylor for the erection of bridge building works in Reading, Pa., in the vicinity of the Reading Rolling-mill. The main building will be about 200x150 feet. Cofrode & Saylor's Philadelphia Bridge Works, at Pottstown, constitute an extensive industry. The one in Reading is to be a very large one, when all the buildings are completed and in full operation, and will give employment to a large number of hands.

Messrs. Joseph S. Davis, P. Melchiors and R. Sanderson, of Omaha, Neb., have recently started a machine shop in that city, where they will give special attention to manufacturing and repairing all kinds of machinery and doing pattern work, model making and general blacksmithing. Their shop is located at 714 South Fourteenth street. The gentlemen named are all practical mechanics who have spent a number of years in machine shops.

The Lozier Mfg. Co., of Toledo, O., are to double the present capacity of their plant. This will give an output of 100 bicycles per day and employment to from 500 to 600 men per day. The directors are A. H. Lozier, C. J. Moore, George A. Burnell, H. A. Lozier, Jr., and Miss Bessie F. Lozier. The officers are H. A. Lozier, president: George A. Burnell, vice-president; H. A. Lozier, Jr., secretary; Charles J. Moore, treasurer and general manager.

The Central Iron and Steel Company, of Brazil, Ind., is building extensive additions to its works, increasing the size of the buildings by one-half. The company is now running to its full capacity, which is 75 tons a day, divided between turnbuckles, car axles, railroad spikes, forgings and bar-iron. Among the proposed additions to the plant is a bolt, nut and rivet department.

It is stated that the Washburn & Moen Manufacturing Co., Worcester, Mass., is about to begin the construction of a new wire-mill at Quinsigamond, Mass. The building, which will be of brick, will be three stories high, 120x120 feet, and from 45 to 48 feet in height. It is expected that the new mill will be finished in less than four months. It will be used for insulating wire, a comparatively new industry. When the building is finished, it will give employment at the outset to about 100 hands.

The Skinner Chuck Co., of New Britain, Conn., are having a large demand for drill chucks and are now behind their orders, though during the last year they have opened another room and put in the best new machinery for the exclusive manufacture of drill chucks. The company's new drill chuck, upon which a patent was obtained last year, will soon be ready for the market, and will be illustrated as soon as cuts can be obtained. Numerous orders have already been received for them. The company also continue their different varieties of lathe chucks, and have recently introduced new face plate jaws, cutting-off chucks and a planer chuck.

Mr. John T. Wilkin, who has been with the Root Co., of Connersville, Ind., for some years as draftsman and designer, and Mr. W.W. Wainwright, who has been for twenty-one years in the machine shop of the same establishment, latterly as foreman, have resigned their positions, and have organized a company, to be known as the Wilkin Mfg. Co., which will manufacture an improved force blower, the revolvers or impellers of which will be constructed with cycloidal curves. This blower and some special machinery which will be used in its manufacture (some of which are being built at the establishment of Pedrick & Ayer, of Philadelphia), are the inventions of the gentlemen named, and it is expected that the new blower will be highly efficient.

Robert J. Stuart, Foundry and Machine Works, New Hamburgh, N. Y., writes us: In the early part of the year I placed a card in your valuable paper, of my patent wedge shaft coupling requiring neither keys or key-seats, which has borne excellent results. Yours is the only paper in which I have advertised, and in the short time calls have come from all parts of this country as well as Canada, France and England, and I have been shipping these couplings with the privilege of being returned should they fail to give entire satisfaction, but have yet to learn of the first one that has not proved satisfactory. I am being hard pushed to fill orders. The other branch of my business, which is the manufacture of light iron and steel cars for tunnel drying, has been very satisfactory for the past year, as well as my foundry business, which consists of light and medium size gray iron castings.

The Columbian Emery Wheel Co., with $6,000,000 capital, was organized under the laws of the State of New Jersey, at Trenton, January 12, 1893. The following were elected directors: Frederick S. Dickson, Philadelphia, Pa.; F. H. Pietsch, Chicago, Ill.; L. Best, New York, N. Y.; C. Ross Grubb, Camden, N. J.; Clarence Tebbets, Waltham, Mass.; F. R. Preston, Detroit, Mich; Harlan Page, Philadelphia, Pa.; George Maitland, Detroit, Mich.; George W. Jackman, Bridgeport, Conn. The following officers were elected: Frederick S. Dickson, president; F. H. Pietsch, vice-president; L. Best, secretary; F. R. Preston, treasurer. The Columbian Emery Wheel Co. has for its purpose the purchase of all of the emery mills in the country, and all of the emery and corundum wheel factories. The headquarters will be in New York City. Preferred stock will pay 8 per cent. dividends. It is expected that the annual sales of this company will approximate $2,000,000.

There is water-works agitation at Maysville, Ky.; Passaic, N. J.; Stillwater, Minn; Olean, N. Y.; Creston, Iowa; Oldtown, Me.; Concord, N. H.; Helena, Mont.; New Orleans, La.; Beatrice, Neb.; College Point, L. I.; Topeka, Kan.; Karnes City, Tex.; Peabody, Mass.; Cambridge, Mass.; Mount Carmel, Ill; Gallipolis, O.; Lawrence, Kan.; Oswego, N. Y.; Altoona, Pa.; Colorado Springs, Col; Attleboro, Mass; La Grange, Ind.; Plymouth, Mass.; Lewiston, Me.; Independence, Mo.; Ishpeming, Mich.; West Bay City, Mich.; Iron Mountain, Mich.; Norwich, N.Y.; Webb, Mo.; Des Moines, Iowa; Quincy, Mass.; Sault St. Marie, Mich.; Hope, Ark.; Moberly, Mo.; Pontiac, Mich; Lyons, Iowa; Ludington, Mich.; Anderson, Ind.; Atlantic City, N. J.; Marquette, Mich.; Oneida, N. Y.; Pittsburg, Kan.; Biddeford, Me.; Owensboro, Ky.; Emporia, Kan; Rochester, Minn; New Canaan, Conn.; Newton, Kan.; Tacoma, Wash.; Jersey City, N. J.; Sioux City, Iowa; Jefferson City, Mo.; Flushing, L. I.; Columbus, O.; Boston, Mass.; Winsted, Conn.; Waukesha, Wis.; Sag Harbor, L. I.; El Paso, Tex.; Santa Rosa, Cal.; Haverhill, Mass; Mankato, Minn; Milwaukee, Wis; Minneapolis, Minn; New York City; Rochester, N. Y; Schenectady, N. Y.; Chester, Pa.; Brooklyn, N. Y.

Machinists' Supplies and Iron.

NEW YORK, January 21, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14 75 to $15.25; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $15 for No. 1 Foundry; $13.75 to $14 for No. 2; and $12.75 to $13 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20 for Eglington.

Antimony—The market is easy and quiet. We quote L. X., 10½c. to 11½c.; Cookson's, 10¾c. to 10⅞c.; Hallett's, 10¼c. to 10⅝c., and U. S. French Star, 10½c.

Copper—The market is weak and speculative interest is absent. Car-load lots of Lake Copper are quoted nominally at 12¼c. Casting Copper is held at 11¾c. to 11⅝c.

Lead—The market here is unchanged. For prompt delivery 3.95c. is asked by the car-load, but no bids are offered.

Lard Oil—Prime City is quoted at 91c. to 92c.; Western on spot at 88c. to 90c.

Spelter—The market is dull; 4.35c. to 4.40c. is quoted for New York delivery.

Tin—A more active feeling prevails; spot is held at an advance to 20.25 cents.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Exp'd mech. draftsman, designer, wants situation. Address Box 90, AMERICAN MACHINIST.

Draftsman familiar with machine tools, jigs, fixtures, etc., desires position. H. M., AM. MACHINIST.

Wanted—Salesmen on commission, to push a special line of mach'y. "KICK," care of AM. MACH.

Wanted—Responsible position, by machinist foreman of much experience. X. Y., AM. MACH.

Six good bench men wanted at once. Address Inman Manufacturing Co., Amsterdam, N. Y.

Mechanical draftsman, technical graduate with shop practice, wants sit'n. A. M., Box 1, AM. MACH.

Wanted—Situation by first-class pattern maker; 10 years exp. Address P. M., AMERICAN MACHINIST.

Wanted—Position by designer & draftsman; exp. in mach. tools, steam, electric & hydraulic mach'y; technical graduate; shop exp. Box 100, AM. MACH.

Wanted—Pattern makers on machine work; good wages and steady work. Address Alex. D. Cunny & Co., 101 East Second St., Cincinnati, O.

Wanted—Two draftsmen for detailing locomotive drawings; no designing; must be quick, accurate & neat; state exp., also sal'y req'd. Box 89, AM. MACH.

Wanted—Position by a successful foreman, mach. tools, eng's, heavy and general work; good manager; up in modern shop practice. Box 88, AM. MACH.

Wanted—A situation as foreman by one of experience, and a practical tool maker and die sinker. Morris Dean, Ilion, N. Y.

Wanted—Pump machinist as foreman, capable of managing 20 to 30 men; state age, exp., salary required. Address Pumps, Box 97, AM. MACHINIST.

Wanted—Position as traveling salesman, by practical machinist (American); good worker; 2 years on the road. Box 98, AMERICAN MACHINIST.

Mechanical engineer, young, educated and energetic, is seeking a position (of promise) in or near New York; fine references. Box 99, AM. MACHINIST.

Wanted—A young draftsman of some experience to work under instructions of an experienced M. E. on engine and boiler work. Address ——, stating experience, and salary exp'd, Box 95, AMER. MACH.

Foreman pattern maker thoroughly familiar with machine to l, steam engine gearing and special machinery desires to make a change; Mass., Conn., or R. I. preferred. Foreman, AM. MACHINIST.

Wanted—At once, by the Webster Mfg. Co., a number of first-class tool makers on fine work. Apply at once, stating experience in full, wages expected, and earliest date of commencement. Chas. E. Davis, Chief Eng'r Webster Mfg. Co., Chicago, Ill.

Machine tool designer, young man with experience now holding good position with prominent builder, will change; can direct attention to a number of machines of my design in successful operation; charge prf'd. W. H., Box 2, AM. MACH.

Wanted—Foreman machinist; must understand drawings and manuf'g work by use of jigs and templates up to best modern practice; a chance to grow for a live man. Answer, giving full particulars and references, Box 96, AMERICAN MACHINIST.

Wanted—First class machinist to take charge of tool room in Corliss Engine Works; one who has had experience and is capable of getting up jigs for special work; steady employment and good wages to right man. Address C. and G. Cooper & Co., Mount Vernon, O.

Wanted—A first-class superintendent to take charge of architectural and structural wrought-iron works who employ 30 to 60 men; one who understands drawings, mak'g estim's & laying out work; positively state salary expected. Address Architectural Iron Worker, AMERICAN MACHINIST.

Bradley Hammers.

If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a BRADLEY HAMMER will soon pay for itself, by what it will save over any other similar tool. Send for circulars.

BRADLEY & COMPANY, SYRACUSE, N. Y.

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Meet all requirements more fully and satisfactorily than any other of its competitors.

INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.

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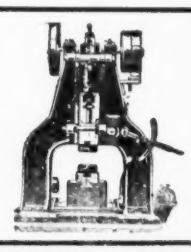

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Gears made or cut to order.
Treatise on gears, $1.00.
Gear Book, fifteen cents.
Gear cutting machinery.
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MANUAL OF STEAM ENGINE.

By Robert H. Thurston.
Part I, Structure and Theory.
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Each part $7.50; or, 2 parts together, $12.00
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NEW FRICTION AND SELF-OILING
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BRASS-WORKING TOOLS.

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Experimental Work of every Description,

Mechanical and Electrical. Contractors for the manufacture of specialties, or can furnish complete plants for their manufacture. Make Dies, Special Tools, Gauges, Drawings, Patterns, Models. Inventions perfected. Estimates furnished. Correspondence solicited.

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PATENT END GRADUATION
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
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PRESSES, DIES AND OTHER
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A TREATISE ON FACTORY MANAGEMENT,
By JOHN TREGONING, M. E., late Supt. Thomson Welding Co.
Being a comprehensive and practical scheme for the better management of factories. Price 40 cents to any part of the United States or Canada on receipt of price. Send check or postal note. No stamps. Address the Author,
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NEW STYLE.
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A Practical Little Book.
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Illustrated with plans and all details.
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WELDLESS
SMOOTH : COLD DRAWN
John S. Leng's Son & Co. New York.

Milwaukee, January 2d, 1893.

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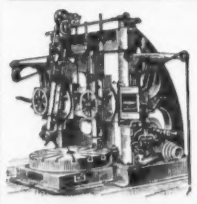
I have just put one of your 2-inch Balanced Valves for controlling feed pump from receiving tank operated by float in tank, to take the place of two different ones that have not given satisfaction; and if all your different products will give as good satisfaction as the valve is doing at present, I shall certainly be a convert to the Mason goods. I am,

Very truly yours,
JOS. BRADSHAW, Engineer Hotel Pfister.



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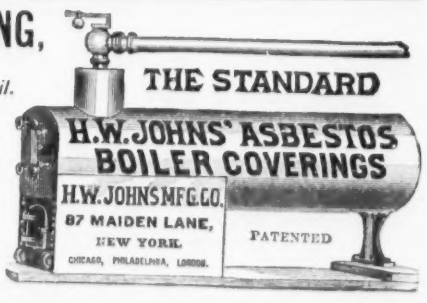

✲WANTED✲

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Wanted—Two active and intelligent young men with some machine shop and drawing room experience for similar service, with the ultimate end of becoming traveling salesmen. State age, previous experience, and furnish references, Manufacturer, Box 260, Buffalo, N. Y.

Wanted—A competent, energetic man as foreman or assistant sup't of machine works mfg. high grade engines, & doing a general business: must be competent to handle 50 men to best advantage, well up in modern shop practice, an educated mechanic and good draftsman preferred; state age, exp., nationality, and salary expected. W. F., AM. MACH.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 25 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M. York, Clev d, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

New Haven screw-cutting lathe 17 'x6 feet, with 16" chuck; massive tool; $125. 229, AM. MACHINIST

DESIRABLE SECOND-HAND MACHINERY.

LATHES.

1 25 in. x 25 ft. L. W. Pond, Compound Rest, Rod Feed.	Good order
1 17 in. x 8 ft. Blaisdell, Rise and Fall Rest.	Good as new
1 17 in. x 6 ft. Blaisdell, Rise and Fall Rest.	Good as new
1 16 in. x 7 ft. Bement, Plain Rest, heavy fine Tool.	A1 condition

PLANERS.

1 30 in. x 30 in. x 8 ft. Hewes & Phillips, Spiral Geared, one head on rail, very fine modern Tool.	Good as new
1 15 in. x 15 in. x 3 ft. Wilkinson.	A1 condition
1 22 in. x 18 in. Blaisdell Crank Planer.	Good as new
1 24 in. x 24 in. x 5 ft. Whitcomb Planer.	Good order

MISCELLANEOUS.

1 4 in. Hubbert & Rogers Cutting Off Machine.	A1 condition
1 20 in. Prentice Bros. Drill, Wheel Feed, with Chuck.	Good order
1 20 in. Reed Drill, Lever Feed, with Chuck.	Good as new
1 3 Spindle Barnes Drill Press.	Good as new
1 No. 1 2-Spindle Garvin Drill.	Good as new
1 No. 2 4-Spindle Garvin Drill.	Good as new
1 No. 3 4-Spindle Garvin Drill.	Good as new
1 No. 2 Brown & Sharpe Screw Machine, Automatic Chuck and Wire Feed.	A1 condition
1 15 in. x 5 ft. Hendey Turret Lathe.	Good order
1 15 in. x 5 ft. Jones & Lamson Turret Lathe, with 3 jaw Universal Chuck.	Good as new
1 No. 2 Garvin Power Miller, Swivel Vise and Arbor.	Good as new
1 No. 4 Garvin Miller, Arm, Vise and Arbor.	A1 condition

Nearly 500 other New and Second hand Tools in Stock. Write for list and prices.

THE GARVIN MACHINE COMPANY,
CANAL AND LAIGHT STS. NEW YORK.

SECOND-HAND AND NEW MACHINERY.

84 in. x 84 x 16 ft. Planer.	3 Head, Niles.	
72 in. x 48 x 33 ft. Planer	3 Heads.	
54 in. x 42 in x 24½ ft. do	2 do	
42 in. x 42 in. x 16 ft. do	1 do	
30 in. x 30 in. x 8 ft. do	1 Head.	
26 in. x 24 in. x 7 ft. do	1 do	
25 in. x 24 in. x 5 ft. do	1 do	
23 in. x 21 in. x 5 ft. do	1 do	

80 in. x 18 ft Engine Lathe.
54 in. x 30 ft. between Centers Niles Engine Lathe.
52 in. x 35 ft. Lathe with Hor. Boring Mill one end. Putnam
60 in. x 45 ft. Double Head Engine Lathe.
42 in. x 20 ft. between Centers, Betts Engine Lathe.
50 in. x 30 ft. Bed, Triple Geared. New Engine Lathe.
30 in. x 28 ft. D. W. Pond Shafting Lathe.

32 in. x 12, 14, 16, 18 ft. Bed.	New	Engine		do
28 in. x 12, 14, 16, 18 ft.	do	do	do	do
21 in. x 10, 12 ft.	do	do	do	do
20 in. x 12 & 8 ft.	do	2d Hand	do	do
18 in. x 6, 7 & 8 ft.	do	New &	do	do
17 in. x 8 ft.	do	do	do	do
16 in. x 6 & 8 ft.	do	do	do	do
15 in. x 6 & 8 ft.	do	do	do	do
14 in. x 6 ft	do	do	do	do

Car Axle Lathe, Bement.
15, 16, 18, 25 in. Crank Shapers.
20, 24, 26 & 30 in. Geared Shapers.
20, 22 24, 28, 30 & 36 in Drills.
Bolt Cutters.
12 Shaper Trav. Head, Two Tables.
Bolt Cutters, Gang Drills, Milling Machines, Punch Presses, Vertical Boring and Turn Mill.
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1100 and 3000 lb. Bement Steam Hammer.
100 and 150 lb. Steam Hammer.
40 H. P. Vert. Engine. N. Y. S. S. P. Co.
11 in. x 18 in. Hor. Engine. A1 Order.
12 in. x 24 in. Corliss do do

GEO. PLACE MACHINE CO.,
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SOFT GRAY IRON CASTINGS.

From ⅛ oz. to 1000 lbs. Small Castings a Specialty. Light machinery wanted to build.

ONTARIO IRON WORKS,
CANANDAIGUA, N. Y.

Pond screw-cutting lathe, 20" swing, 10-feet bed; perfect order; $175. 229, AM. MACHINIST.

Vertical boiler, 15 horse, with engine; no brickwork; $200; tested 150 lbs. 229, AM. MACHINIST.

Pattern maker's lathe, head and tail stock, with face-plate, 20" swing. 229, AMERICAN MACHINIST.

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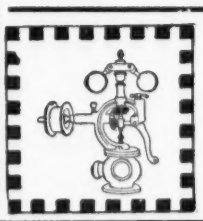

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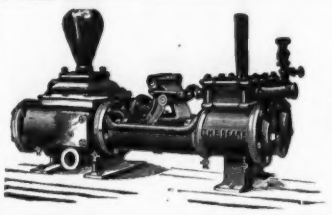

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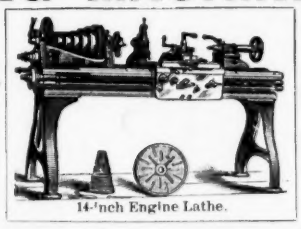
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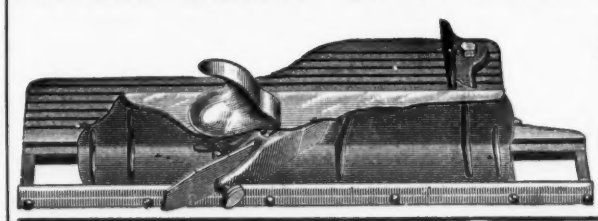

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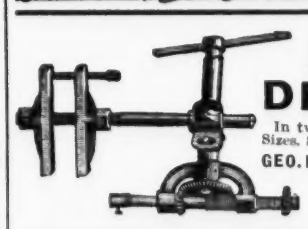

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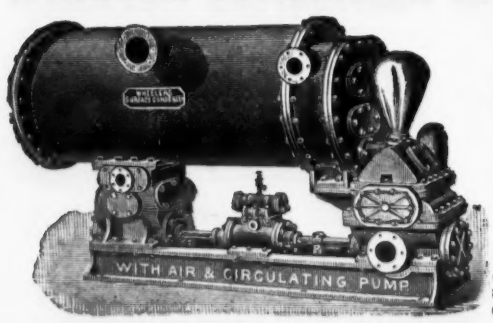

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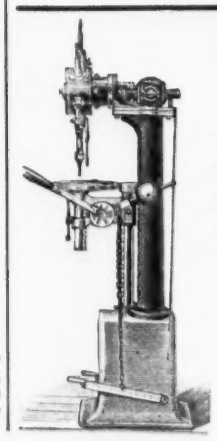

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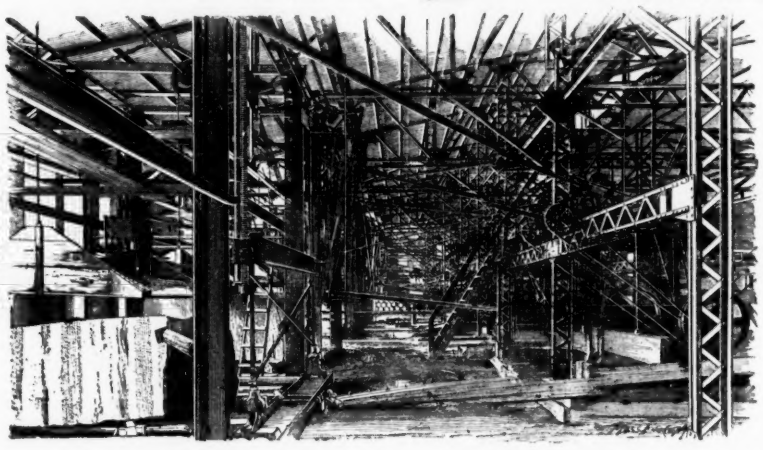

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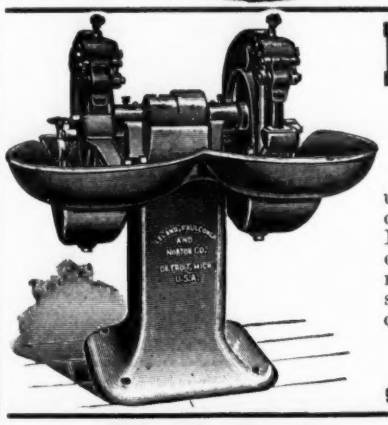

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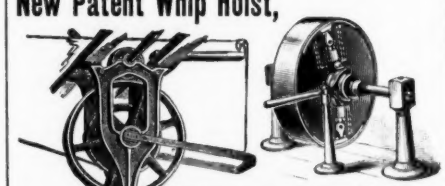

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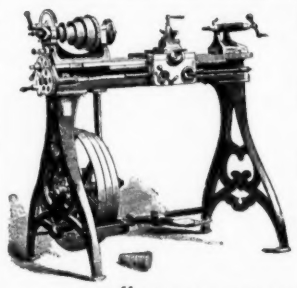

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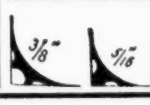

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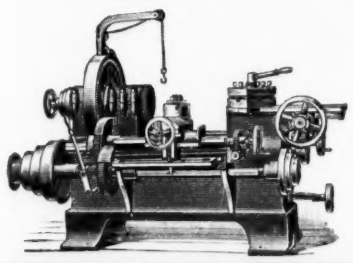

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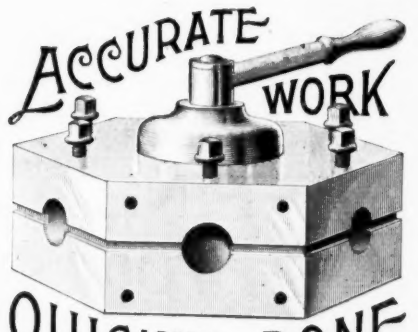

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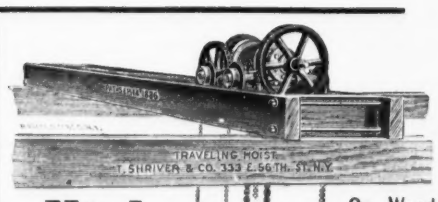

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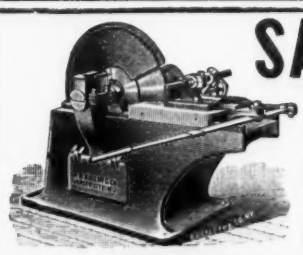

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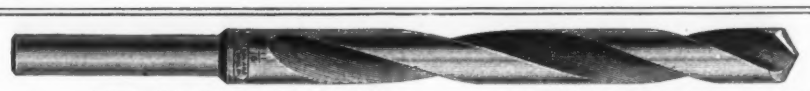

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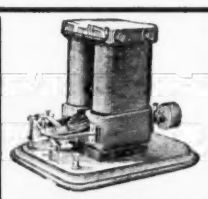

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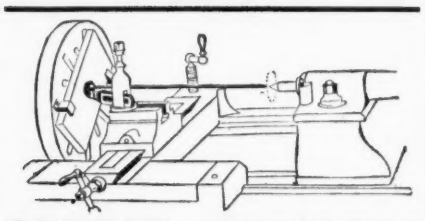

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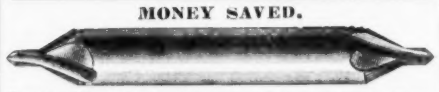

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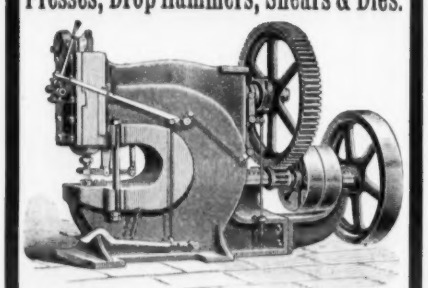

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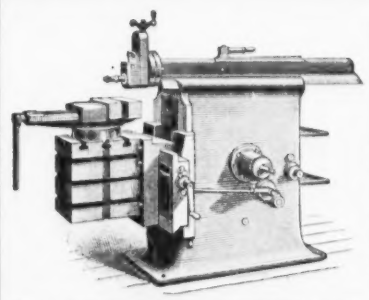

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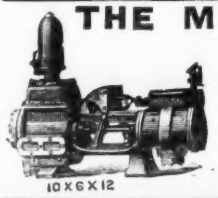

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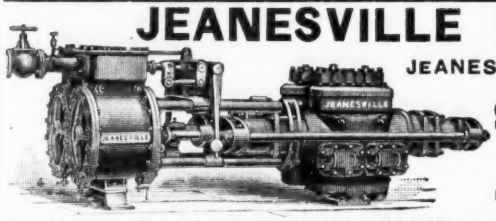

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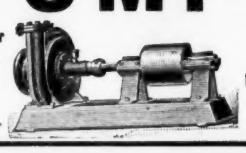

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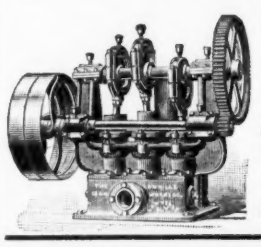

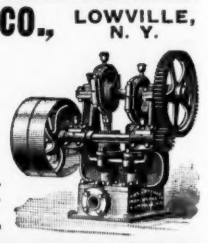

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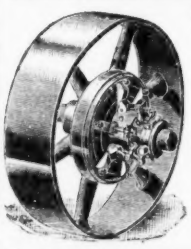

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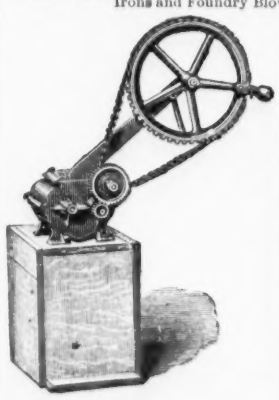

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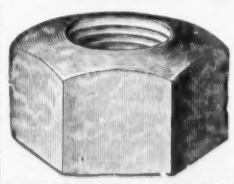

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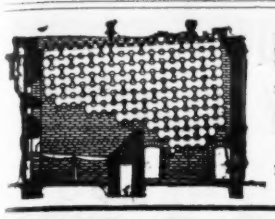

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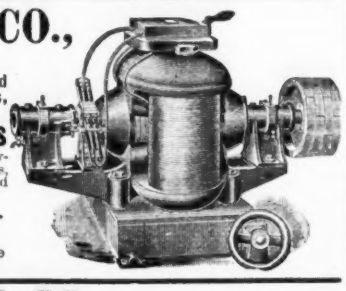

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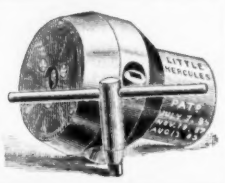

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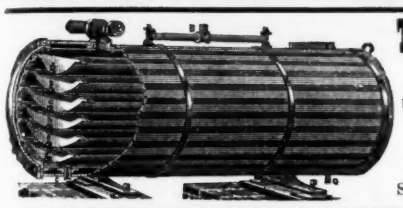

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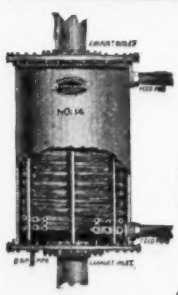

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24 "	28 "
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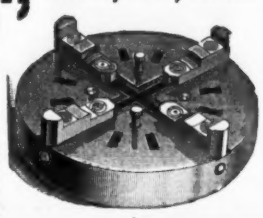
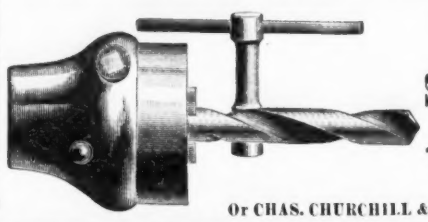
36 "	40 "





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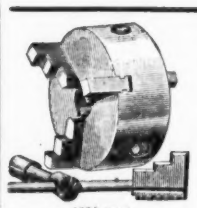
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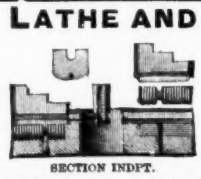
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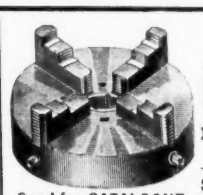

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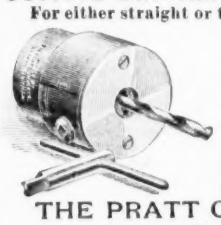

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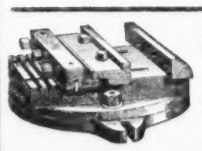

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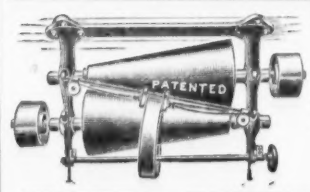

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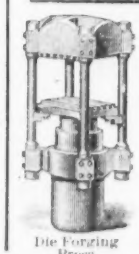
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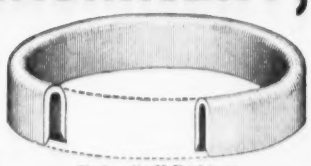
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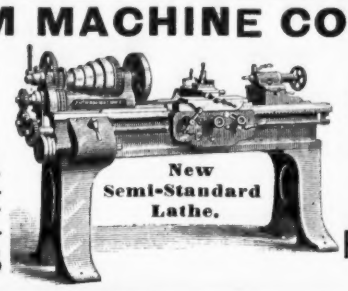

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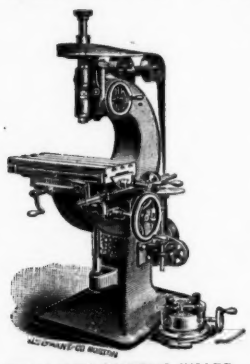

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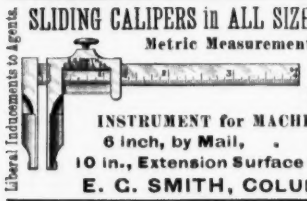

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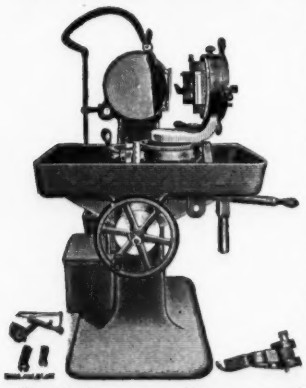

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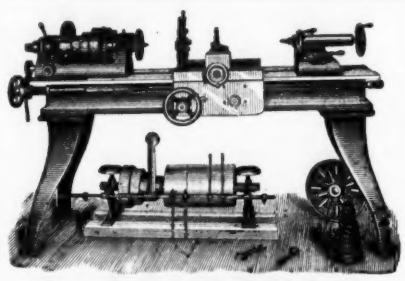

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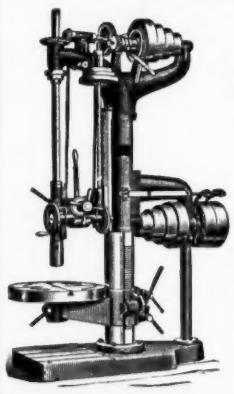

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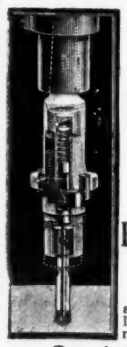

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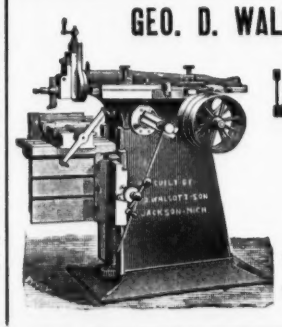

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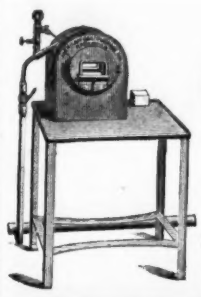

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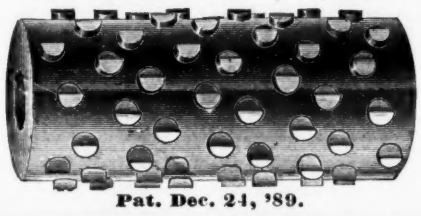

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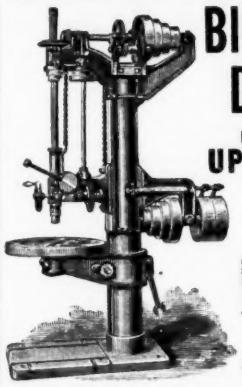

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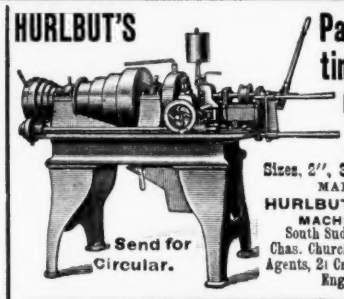

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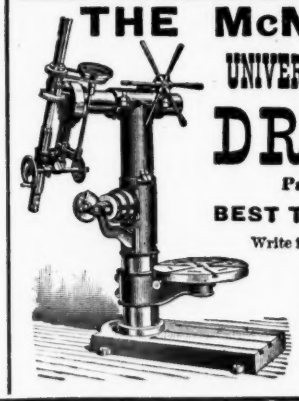

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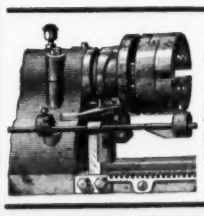

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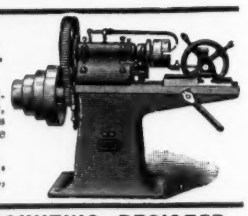

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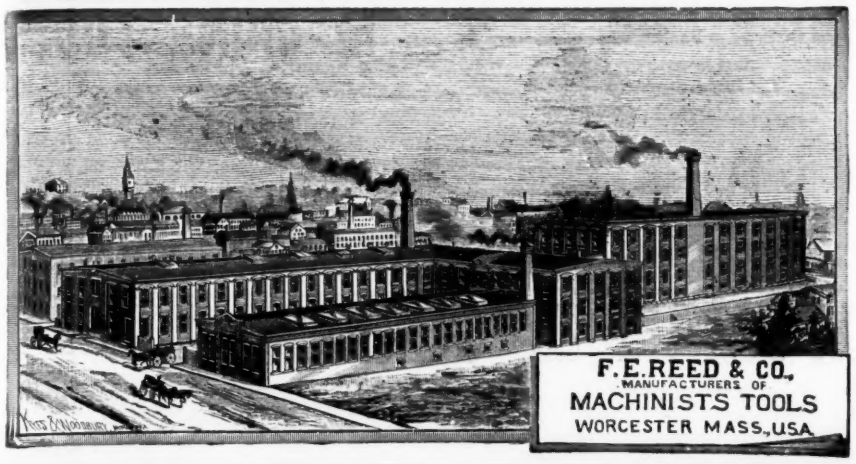

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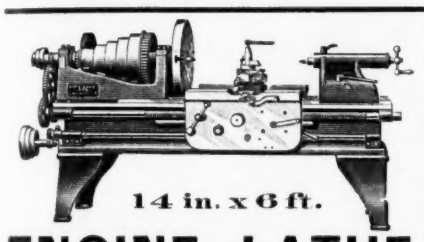

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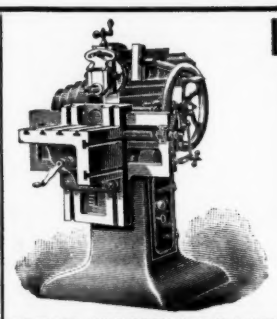

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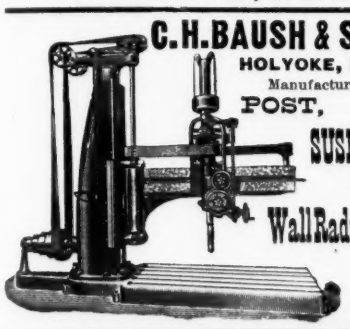

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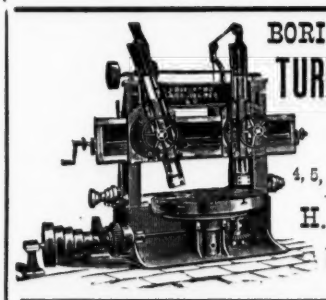

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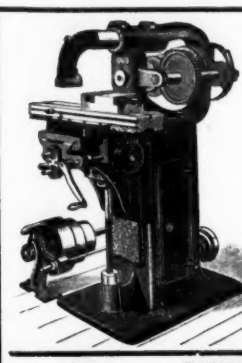

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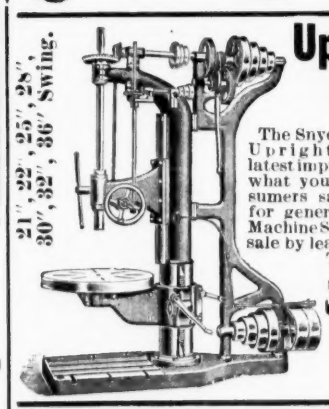

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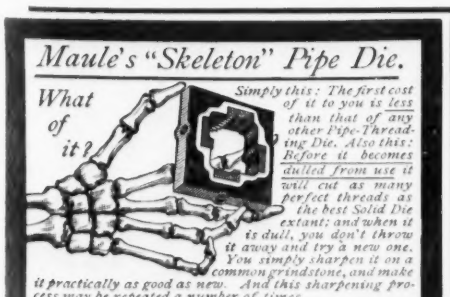

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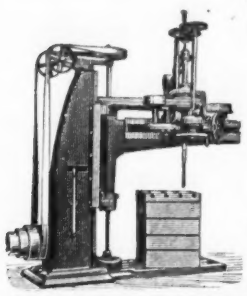

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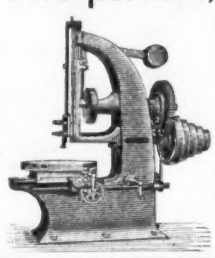

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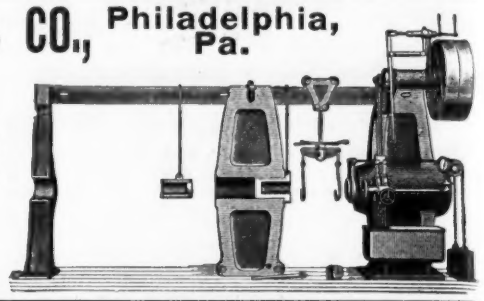

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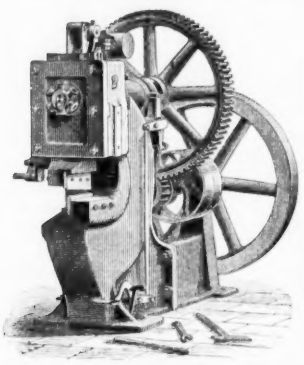

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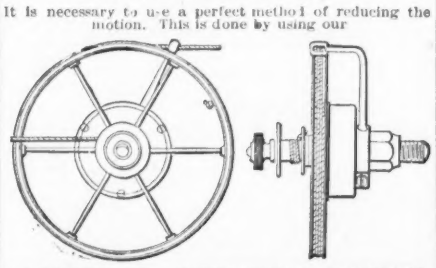

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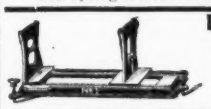

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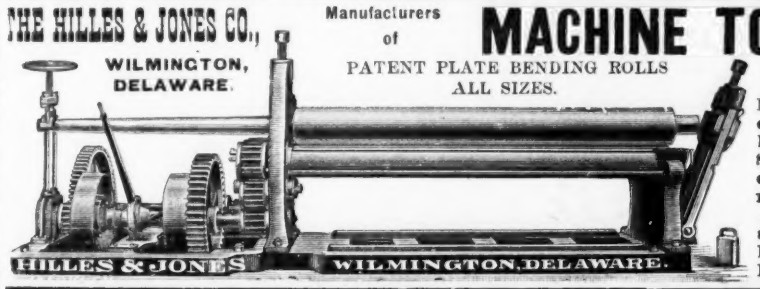

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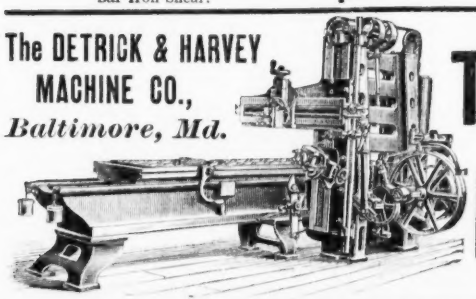

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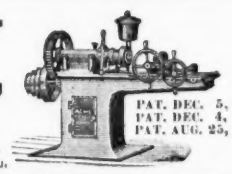

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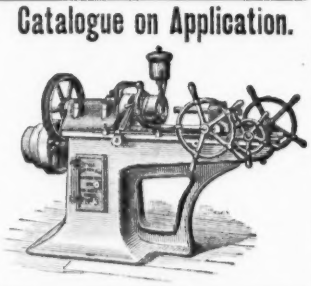

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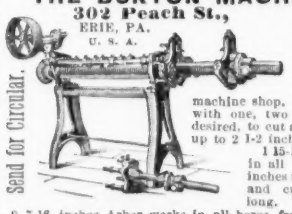

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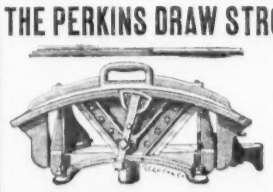

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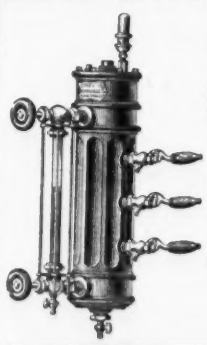

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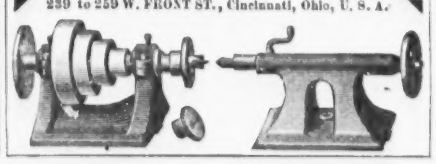
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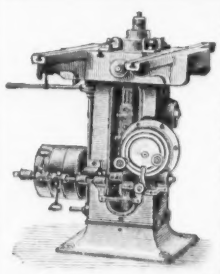

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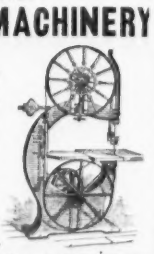

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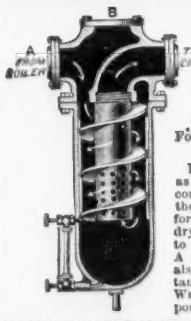

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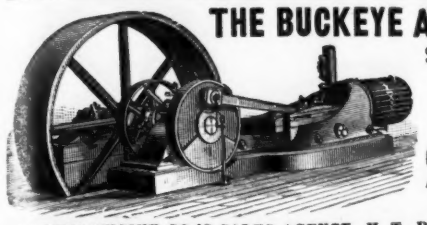

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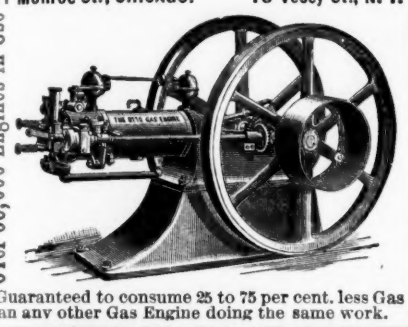

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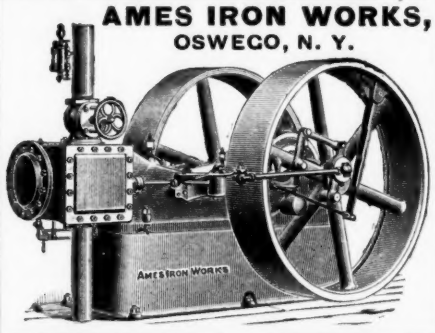

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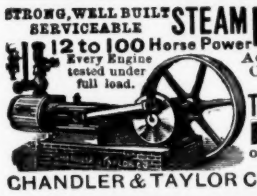

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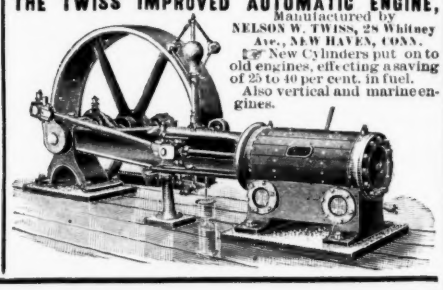

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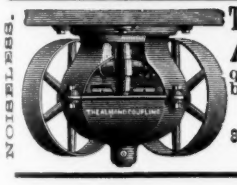

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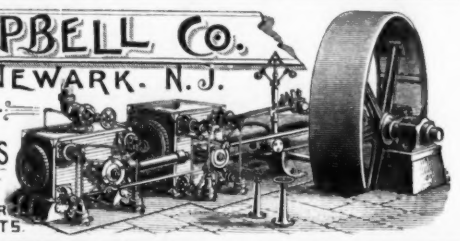

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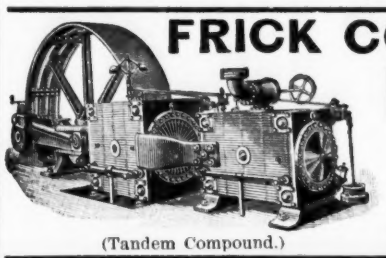

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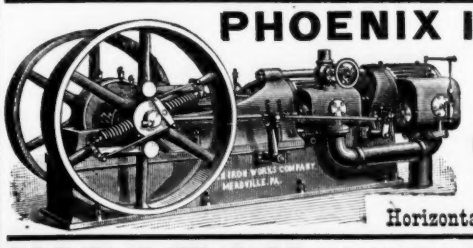

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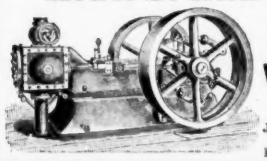

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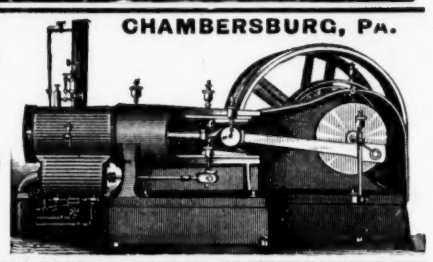

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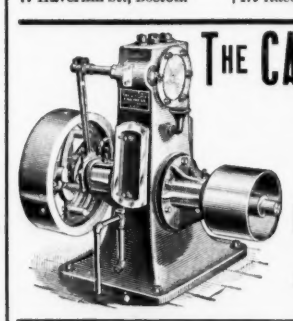

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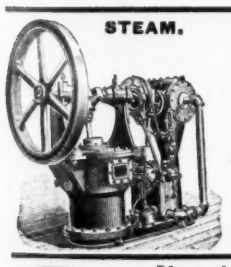

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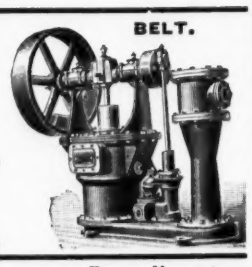

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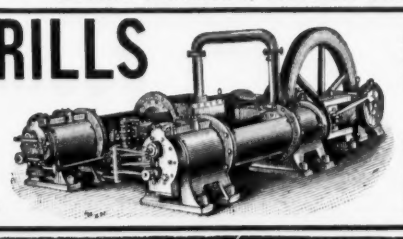

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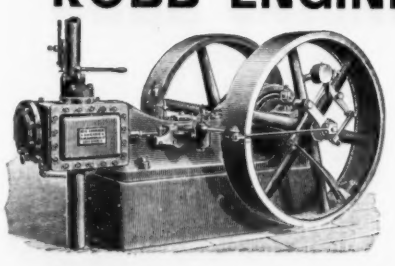

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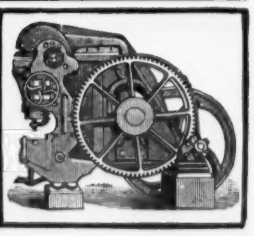

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of many of our Machine Tools have already been made and will be followed by others. Some of our competitors, while acknowledging their good quality, have for years persistently told their customers they could not afford to buy them on account of their high price, and this statement has in many cases prevented parties preferring our tools from even making inquiries regarding them, thus illustrating an old saying, "A lie well stuck to is as good as the truth." It is our purpose to reduce the prices of all our products as fast as is consistent with good quality and cost, and we take this opportunity to request intending buyers to write us for prices before placing their orders.

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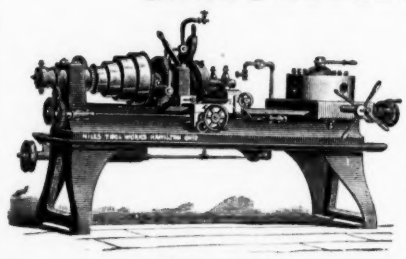

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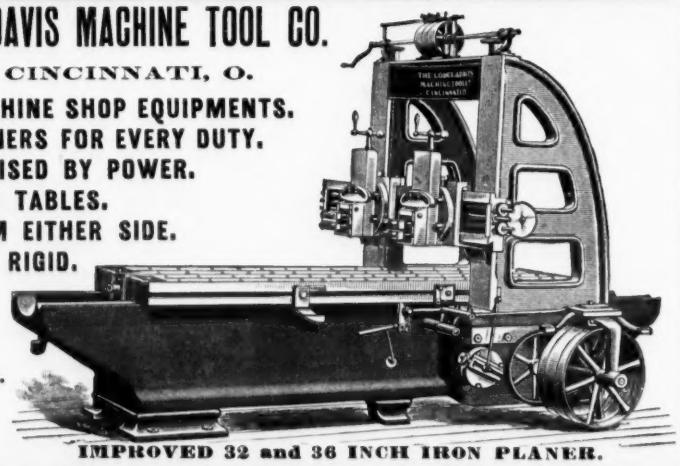

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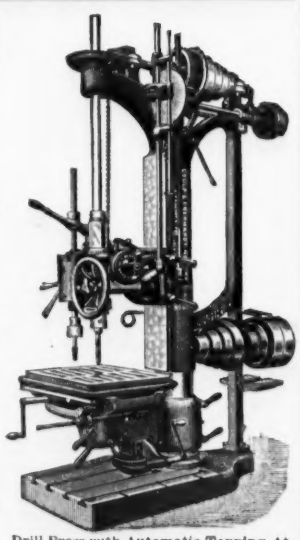

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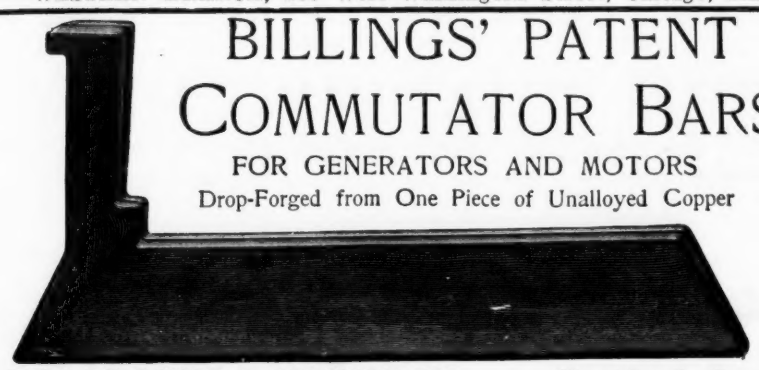

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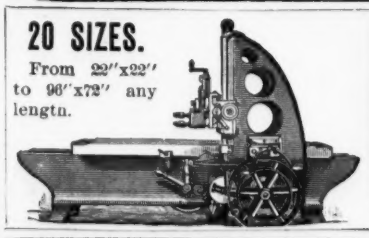

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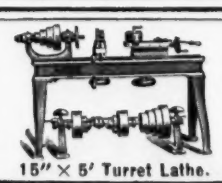

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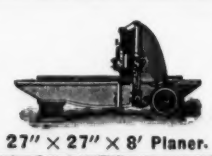

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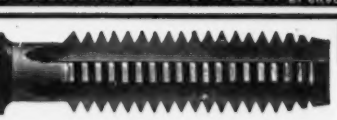

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